


HANDBOOK OF SPRINKLER DEVICES

BY

GORHAM DANA, S.B.

MANAGER, THE UNDERWRITERS' BUREAU OF NEW ENGLAND,
BOSTON, MASSACHUSETTS

PUBLISHED BY

THOMAS GROOM & CO., INC.

105 STATE STREET, BOSTON

1914

Stanbope Press
F. H. GILSON COMPANY
BOSTON, U.S.A.

PREFACE

BELIEVING that a description of all the automatic sprinkler devices that are liable to be found in the field would be of service to fire insurance inspectors and others, the author presents herein four chapters from his book on Automatic Sprinkler Protection in handbook form.

These chapters cover the following subjects: Alarm Valves, Dry Valves, Sprinkler Supervisory Systems and Automatic Sprinklers. The chapter on the latter subject contains several references to previous pages for a further description of certain devices. These page numbers refer to pages in the complete volume to which the reader is referred for a more extended treatise on the subject.

While the subject matter may be somewhat incomplete and disconnected when published in this form it is hoped that it may prove useful to the field man as a reference book.

GORHAM DANA.

April, 1914.

CHAPTER I

ALARM VALVES

An alarm valve is a very inexpensive and valuable addition to the fire protection in a sprinklered risk and is strongly advised for every equipment. It consists of a device which is installed in the main sprinkler riser and is arranged to actuate some form of alarm as soon as water flows through the system. These alarms are of two types: rotary gongs, operated like water wheels, by the passage of water through them; and electric gongs, operated by the movement of a check valve or by the closing of an electric circuit through the action of water pressure on a diaphragm. Alarm valves are valuable for two reasons: they give an alarm when sprinklers open on account of fire, thus acting as a fire alarm; and they give warning in case of flowage through the system for other causes such as a broken pipe, opening sprinkler head, etc. For the latter reason they are of great importance from a sprinkler leakage point of view, and most companies insuring against this form of loss require either an alarm valve in the system or standard watchman's service in the risk insured.

TYPES

There are two principal types of alarm valves that have been successfully used. In one a check valve is placed in the main water pipe and the movement of the clapper when water begins to flow, transmitted usually through a packed stem, is used to actuate the alarm. In the other type a check valve is also used and this, when in its normal position, closes an outlet to a small

pipe running to the alarm devices. This is accomplished by having the small pipe run from a groove in the valve seat, a horn in the water way or an auxiliary valve outside the main water way. In any type, a retarding or interrupting element should be used to retard the alarm long enough so that water hammer will not produce a false alarm.

The early valves were of the first type and usually had no retarding element. The most common variety was that using a swing check with an arm attached which extended through a stuffing box to a lever on the outside. This lever was so arranged that when it was moved forward by the opening of the check, a mechanical gong was tripped or an electrical circuit connected to a bell was completed.

This was a very crude form of alarm valve and particularly defective in the following points:

1. Sticking of the packed stem. The packing used to make a tight joint often caused the stem to stick owing to its age or to its being packed too tightly. In many cases this sticking was great enough to cause a serious menace to the equipment by obstructing the water way.

2. Susceptibility to false alarms. Any valve of this character, having no retarding element, is very liable to give false alarms from water hammer. A slight impulse in the water would force the clapper off its seat and would probably give an alarm if the device was adjusted to operate for small flows.

3. Lack of sensitiveness. Where the movement of a large check valve is used to give an alarm it is evident that the amount of water necessary to feed one sprinkler head would only open the valve a very small amount. It is therefore very difficult to adjust the device so that it will operate for small flows caused by the opening of one or even two heads.

4. The valves were liable to stick open. This was

especially the case where the lever was weighted so that when it started to move the weight would carry the clapper over to the wide open position.

In addition to the above the electrical and mechanical gongs used at this time were crude and unreliable. The mechanical gongs had to be rewound each time they operated and this was frequently forgotten. Valves of this type have not been installed to any extent for many years and but few are now found in the field.

HISTORICAL SKETCH

In 1881 *Mr. J. C. Meloon* of Providence patented an alarm valve of the vertical check type in which the movement of the clapper operated an auxiliary valve which admitted water from below the check valve to a chamber. The water pressure in the chamber actuated a diaphragm which, when it moved, tripped the catch of a mechanical alarm.

In 1884 *Mr. Charles E. Buell* patented a valve of the packed stem type in which the lever attached to a swing check started a train of clockwork actuated by a weight. This rang a mechanical gong. The Walworth Manufacturing Co. also made some valves of this general type.

Another of the early valves of this type was the *Neu.* This was a vertical check valve seating like a globe valve on a horizontal seat. A spindle extended through a stuffing box at the top and closed an electrical contact when the clapper was raised by the flowage of water. This had practically all the defects of the swing check type except the liability to stick open.

The *Grinnell Angle Alarm,* so-called, was somewhat similar to the Neu. It was a vertical check of the angle type. A rod attached to the lower side of the check valve contained a groove, and a horizontal pin passing through a stuffing box to the outside of the casing rested

in this groove. When the valve opened the pin was pushed a short distance forward thus making an electrical connection or tripping a mechanical gong.

This valve was an improvement over the old swing check as it was less subject to false alarms. The valve could lift slightly without giving an alarm and there was less chance of sticking. Like the older valve, however, it had no retarding element and was difficult to adjust so as to be sensitive to small flows and at the same time not to be subject to false alarms.

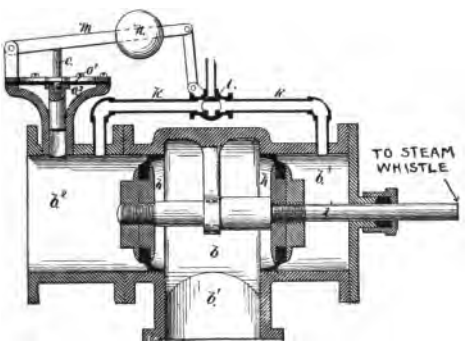
In 1888 *Messrs. R. Dowson and J. Taylor* of Bolton, England, patented in this country the well-known English Alarm Valve. This was manufactured by the General Fire Extinguisher Co. for many years and is still used in a slightly modified form. It is also the basis of several other valves and embodies perhaps the most successful principle that has ever been used in alarm valve construction. It consisted of a vertical check valve having a grooved seat. A pipe extended from the groove to a rotary gong actuated by the flow of water. When the valve was seated, the groove was tightly covered by the clapper and no water could escape. When the valve was raised by flowage in the system, the water entered the groove and flowed to the water rotary gong.

In the original valve there was no retarding chamber and the valve was therefore somewhat subject to false alarms from water hammer. There was, however, a small compensating valve located in the main check valve which allowed water in small quantities to pass upwards through the alarm valve but not back again. This was installed to prevent trouble from water hammer by building up an excess pressure in the system above the main check valve.

The same year (1888) *Mr. Frederick Grinnell* patented a very ingenious device which, however, was never put on the market so far as known. The principle involved

was apparently a very effective one for preventing false alarms from water hammer although in case it failed to work properly it completely blocked the water way.

It consisted of a double or balanced valve comprising two self-packing pistons $h - h$ located several inches apart and connected by a rod running in a guide. The pipe from the water supply b' was connected between



GRINNELL ALARM DEVICE 1888.
(Section.)

the two pistons, when in their normal position, so that there was an equal pressure on each, thus balancing the valve.

The cylinder in which these two pistons could move horizontally was connected at one end to the sprinkler riser and at the other end to a pocket b^3 normally full of water. A rod i connected with the pistons extended through the pocket and a stuffing box to the outside of the casting. Here it came in contact with a valve supplying a steam whistle. A small by-pass k extended around the two pistons of the alarm valve connecting the sprinkler riser with the pocket. In this by-pass was a three-way cock l which when in its normal position left a free way through the by-pass, thus equalizing the water pressure in the riser and in the pocket.

This three-way cock was connected to a lever arm *m* actuated by a flexible diaphragm *o* and connected by a short piece of pipe to the riser. When in normal position the two pistons spanned the inlet pipe and prevented any flow of water into the riser. Any water hammer or variation in pressure acted equally on both pistons and gave no alarm. When, however, a sprinkler operated the pressure in the riser was reduced. This caused the diaphragm to drop, thus moving the lever downward and changing the position of the three-way cock so as to close the by-pass but open a passage from the pocket to a waste pipe. This relieved the pressure in the pocket thus causing the two pistons to move in that direction to the limit of their travel. This opened the main water way from the supply pipe into the riser and at the same time operated the steam whistle.

The *International* valve was of a somewhat similar principle to the English Alarm valve. Instead of a grooved seat, however, a horn was used. This horn extended from outside the casing to the under side of the main clapper of a swinging check valve. When the clapper was on its seat, it also closed the open end of the horn. When the clapper was raised, the water flowed into the horn, hence through the retarding chamber to the circuit closer and rotary gong. The retarding chamber was, however, of an entirely different principle from that used in the English Alarm valve as will be described later.

The first *Rockwood* alarm valve was practically a copy of the English valve. The present type has a grooved seat and, in addition, a by-pass containing an auxiliary valve to care for the small flows.

The *Venturi* valve made by the Venturi Alarm Co., and installed by the Manufacturers' Automatic Sprinkler Co. (later by the "Automatic" Sprinkler Co. of America), is of a radically different principle from any other alarm valve.

There is a weighted swing check in the main water way but no grooved seat or horn. There is a by-pass around the check valve containing a Venturi tube, that is a tube containing a restricted portion or throat. Water flowing through such a tube has an increased velocity accompanied by a decrease in pressure at the throat. This difference in pressure is made use of to give an alarm by piping one side of a mercury column to the throat, and the other side to the full-sized pipe below the throat. A heavy iron float rests on one side of the mercury column and when water passes through the by-pass, owing to flowage in the system, the float falls and its movement opens an outlet which allows the water to flow to the alarm devices.

In February, 1908, *Mr. E. L. Thompson* of the Manufacturers' Automatic Sprinkler Co. patented an alarm valve which operated entirely on account of reduction of pressure in the system when a sprinkler opened. It was a complicated device containing a balanced valve which fell when the pressure was reduced thus allowing water to pass into a pipe which operated an electrical and water rotary gong. This was never used in practice so far as known.

Mr. Geo. E. Hibbard of Chicago patented a valve in 1903, which could be used either as an alarm or dry valve. This depended upon an excess pressure being maintained above the valve and was never used so far as known.

INSTALLATION

In all types of alarm valves great care should be taken in the matter of installation. Most of the valves on the market have had a remarkably good record so far as giving an alarm in case of fire is concerned, but the record of false alarms has not been satisfactory. The greater portion of this trouble has, however, been due

to defective installation. A few of the more important points that are often overlooked are the following:

1. Vent for circuit closer. There should be a small outlet about $\frac{1}{8}$ inch in diameter located under each circuit closer so that when the water flow ceases the pressure under the diaphragm will be released at once and the circuit will be thereby broken. This also allows the pipe from the diaphragm to drain quickly by admitting air at the upper end. The vent should be piped through a visible outlet and so arranged that water discharged from it will do no damage.

2. All drips should run to the space under the building or out of doors in such a manner that the chance of clogging or freezing will be reduced to a minimum. Drips running to a sewer are liable to cause trouble by the backing up of water which may operate the alarms. When it is necessary to connect to a sewer, the drip pipe should run into an open cup or into a pipe of larger diameter, this latter pipe running to the sewer. The top of the cup can be closed with a sliding cover if desired and this, not being air-tight, will prevent any back pressure from reaching the retarding chamber. The piping should be arranged so that the end of the drip can be easily inspected for leaks. If necessary a trap can be placed in the large pipe that connects with the sewer. The drip from the circuit closer can easily be carried to the same drain pipe.

3. The water rotary gong should be located as near the alarm valve as possible. If located at too great a distance from, or at too great an elevation above, the alarm valve, the loss of head entailed may cause trouble. In case the length of pipe is over 15 feet it is desirable to enlarge it to at least 1 inch diameter. This pipe should be arranged so that it will drain quickly.

There should be a substantial hood and screen over the gong to prevent clogging by ice, birds' nests, etc. These are usually supplied with the valve.

RULES FOR DESIGNING AN ALARM VALVE

The following specifications give a general idea of the requisites for a satisfactory alarm valve.

1. Must be capable of actuating and maintaining in operation either mechanical or electrical devices, or both.

2. The electrical alarm type must be capable of actuating an electrical circuit opener or closer, according to the character of the alarm circuit to which it may be connected.

3. The combination electrical and mechanical type must operate to set and maintain in operation both alarms, or either independently.

4. Must operate at all rates of water delivery from the system, exceeding ten (10) gallons per minute.

5. The retarding factor must not exceed thirty (30) seconds. The retarding factor is here defined as the time elapsing between the first movement of water past the valve due to opening of a system outlet and the completion of the act by which the valve actuates the alarm devices; it is not construed as including the delay incident to excessive lengths of connecting pipes leading to such devices, or other delays which may be largely dependent in magnitude upon details of installation or excess pressure above the valve.

6. Must be equally operative, without special adjustment, at all service pressures for which it is rated.

7. Must discontinue alarms on stoppage of flow.

8. Must be capable of transmitting successive alarms without manual resetting.

9. Must not spatter water upon the surroundings of the valve nor cause waste of water.

10. Must not give false alarm under any variation in service pressure for which it is rated.

11. Must be substantially constructed and not embody delicate parts.

12. Must not waste water while in service and not in operation.

13. Must not depend on moving parts which are liable to become stiffened by corrosion, other results of lapse of time or by misadjustment.

14. Must be so designed as not to invite improper adjustment in the field.

15. Must not require frequent renewal, or adjustment of parts.

16. Must have all working parts readily accessible for removal and repairs.

17. Must be made up and shipped from the factory in such form as not to be liable to incorrect installation or assembly.

18. Must not be susceptible to accumulation of foreign matter.

19. Must not be liable to failure from the effects of corrosion, sticking of parts or ordinary accumulation of sediment and other foreign matter from the piping.

20. Must not possess sufficient differential properties to cause danger of water columning in service or undesirable action in operation.

21. Must not depend, for proper action, on manually-wound spring motors or any other form of motive power which is liable to be out of commission when needed.

22. Electrical contact devices must be so protected from moisture that they will be dry under all conditions short of actual submerging of the apparatus.

23. Must not invite internal or external gagging. The necessary test valves and devices must be as simple as possible. If of such nature or so located that they may be carelessly left in condition to render the alarm devices inoperative, provision must be made for pad-locking or sealing them, in proper operative condition only.

24. Must not cause excessive loss of pressure by hydraulic friction.

NATIONAL BOARD RULES FOR ALARM VALVES

See Sprinkler Rules Section G.

The National Board rules for alarm valves state that every sprinkler system should contain an alarm valve that will operate an electrical, a mechanical gong or both. The character of the property and the local conditions should determine just what bells should be used and where they should be located. In a city risk the electric bell should if possible be located in a fire department house or in a central station. It is also very desirable to wire it on a closed circuit in such locations. It is often advisable to omit the rotary gong when the risk is located in a congested district on account of the panic or the frightening of horses which might result from the ringing of so large a gong.

In small towns or villages both electric and rotary gongs are desirable and the electric bell should be at a fire department house or in the dwelling of some inter-

ested party. In some cases, the electric bell can be located in the power house of some nearby plant where there is some one on hand nights, Sundays and holidays.

The alarm valve should be so located that the supplies from all automatic sources will pass through it. This excludes steamer connections and occasionally pump supplies although it is usually better practice to have the pump water pass through the alarm valve. This necessitates bringing all water supplies together below the valve, as, for instance, bringing the tank supply down to the basement level and connecting it with the town water supply under the main gate valve and alarm valve. It was formerly customary to feed the tank supply into the top of the riser but this is not allowed today, except in the case of risks having no other supplies than gravity or pressure tanks. In this case, which is sometimes found in cities having a waterworks system of very light pressure, the alarm valve and controlling gate valve may be located at the top of the building thus doing away with the extra friction loss due to the water flowing down to the low level and then returning through the riser.

The wiring for electric bells should be in conformity with the rules given in the National Board of Fire Underwriters' pamphlet on *Signalling Systems.*

TESTING

All alarm valves should be tested occasionally to make sure they are in good working order. Once a week should be often enough under any conditions and once a month is frequently sufficient.

The principal sources of trouble to be looked for are: the failure of the electric bell due to exhausted batteries, corrosion at bell or broken wire; the failure of the rotary gong due to clogging at the outlet or binding of parts; sticking at the seat of the valve. This latter

is infrequent, but occasionally occurs with valves having a soft rubber seat especially if there is a heavy water pressure on top of the clapper. The electric bell is by far the most usual part of the device to get out of order, largely due to battery trouble, and it is well to test this as often as once a week. This can be done by short-circuiting the wires without disturbing the alarm check or the water rotary. A push button should be installed for this purpose connected directly to the binding posts at the circuit closer and not tapped into the wires running to the bell. In this way the entire circuit is tested and if the main wires are corroded or broken off at the binding posts this fact would be brought out on test. If the push button is tapped into the wires running to the bell, any break at the binding posts or between them and the point where the button is tapped in would not be discovered by the test.

A testing device giving a record of the test on a paper dial is very desirable. A small tester, made on the same principle as the test clock for thermostat systems, was formerly made for this purpose but so far as is known there is nothing on the market today suitable for this purpose.

It might be possible to use a small magneto actuated by the rotary gong instead of batteries for supplying current to ring bells, thus doing away with one of the most frequent causes of trouble.

When a closed outside circuit is used, the wires are always in test and it is not, therefore, necessary to make frequent tests of the electrical features.

The best way to make a complete test is to open the small (usually half-inch) test pipe at the top of the sprinkler system. If this is properly installed it should give a flow, when wide open, approximately equal to the discharge from one sprinkler head, and this is the minimum flow at which an alarm valve can be expected to operate.

Defects. The principal defect in alarm valves today is the liability to false alarms. A modern valve properly installed should give but little trouble but if not installed strictly according to rules, trouble may be expected. This trouble is often overcome by maintaining an excess pressure in the system above the alarm valve. There is no great objection to doing this except that it causes extra work and if carried to an extreme may tend to cause the valve to stick. It also makes the valve slower in operation as the excess pressure must drop to normal before the main check will open. In plants where this is done the Assured usually do not test the system as often as it should be tested and also object to tests being made by insurance inspectors.

In alarm valves containing soft rubber facings the rubber ring should be replaced every few years and perhaps oftener where the pressure is very heavy.

FIRE RECORD

While the record of alarm valves is not very satisfactory so far as false alarms is concerned, and while they are frequently found out of order on inspection, their fire record has certainly been good. The statistics of the National Fire Protection Association for 15 years covering various forms of alarm service are as follows:

	Fires	Failures	Per cent of failures
Thermostats alone.....	189	40	21
Watchmen alone.....	1002	90	10
Sprinkler alarm alone.....	840	62	7

APPROXIMATE COST

Alarm valves cost from $100 to $150 each according to size.

ALPHABETICAL LIST OF ALARM VALVES

ASSOCIATED

Associated Automatic Sprinkler Co., Philadelphia, Pa.

A–1914. This is a new device not yet developed to a point where details can be given. It has, however, a retarding chamber for use where pressure is variable.

ASSOCIATED ALARM VALVE.

The electric circuit closer and rotary alarm are of the usual type.

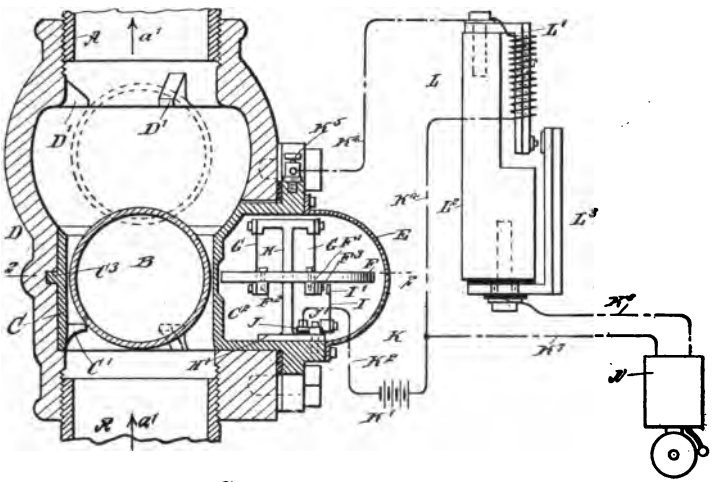
It is to be installed by responsible and capable licensees in various parts of the country.

CARPENTER

Patented by *Orville Carpenter of Pawtucket, R. I.*

1897. (Probably used before that time.) This was a magnetic valve with no provision for a water rotary attachment. A hollow iron ball *B* was used which when in its normal position rested on lugs *C′* in the water way,

which it practically filled. Above this point the water way was enlarged so that when the ball was carried up by the movement of water it did not seriously obstruct the flow. There were also lugs D' higher up, to limit the height to which the ball could rise.



CARPENTER ALARM VALVE.
(Section.)

Outside the main valve casting and separated from it by a tight brass partition $C2$ was a brass casing containing a suspended magnet F, one end of the magnet coming close to the brass partition so that the iron ball was in the field of the magnet.

When flowage occurred in the riser, the iron ball, which nearly floated, was carried up, thus taking it outside the magnetic field. The suspended magnet then swung back away from the partition, and in so doing closed an electrical circuit at I. This was arranged to ring an electrical bell at any desired location, through a retarding element.

This valve was used in a few equipments but did not

prove satisfactory. There was a possibility of the ball becoming filled with water and thus being too heavy to operate properly.

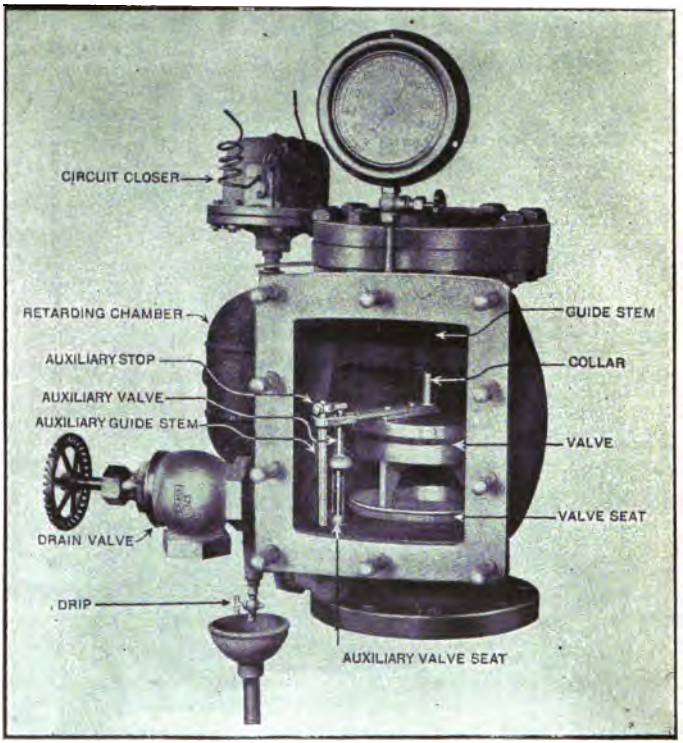
Practically obsolete.

Rating: *Unreliable.*

CROWDER

Made by *Crowder Bros., St. Louis, Mo.*

1909. Vertical check seating on a horizontal valve seat. It is guided by a stem at the top and three projecting brackets underneath. There is an auxiliary



CROWDER ALARM VALVE.

valve attached to the main valve and closing over an opening running to a retarding chamber. When the main valve is on its seat, the auxiliary valve closes the outlet to the retarding chamber. There is a small petcock in the pipe to the chamber and this is normally open.

When the main check rises, the auxiliary valve is opened and water flows into the retarding chamber. The retarding action is due to the difference in capacity of the pipe to the retarding chamber and the open drip through the petcock. There are no valves in this chamber. Said to operate under normal conditions in 5 to 8 seconds.

Rotary gong when used is connected to the pipe running to retarding chamber at petcock.

Has been used since 1909; about 60 installed to date. Field experience said to be satisfactory.

Rating: *Not standard.*

EVANS

Merchant & Evans Co., Philadelphia, Pa.

A–1914. Made in 4- and 6-inch sizes. Consists of an angle check which can be used in a vertical or horizontal position. The outlet to the alarm devices is opened by the lifting of the main clapper. The retarding chamber causes an interruption of 15 seconds. The electrical circuit closer and rotary gong are of the usual type.

All details not yet worked out.

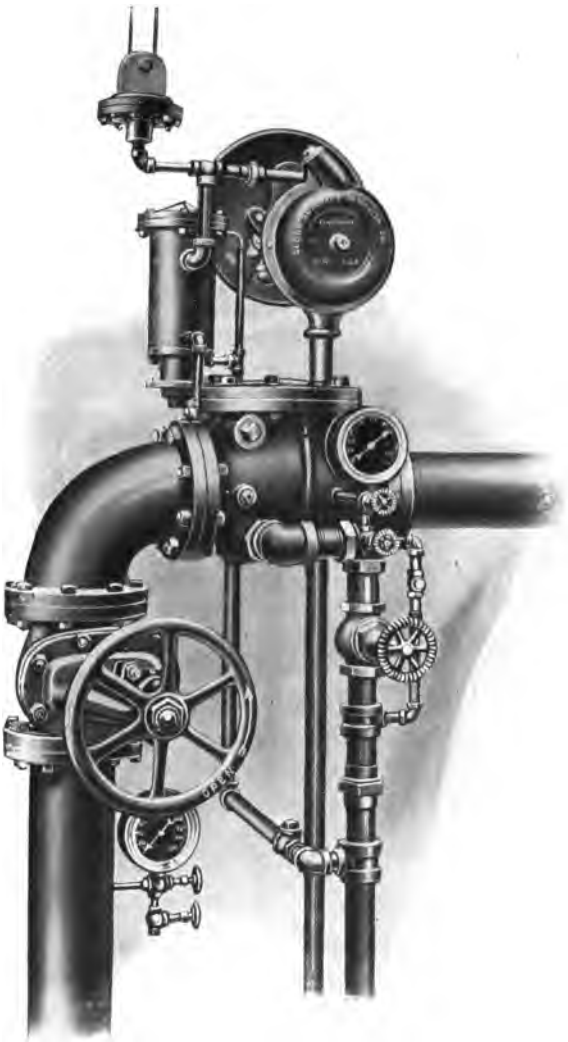
GRAY

Frank Gray, Chicago.

1897. Double vertical check valve on a single spindle running in a guide. From the intermediate space between the two valves a pipe ran to a small chamber containing a cylindrical float. This chamber was drained by a small open pipe. There was a small by-pass around the two valves to take care of water hammer.

EVANS ALARM VALVE. EXTERIOR AND ROTARY GONG.

EVANS ALARM VALVE SHOWING INTERIOR.



GLOBE ALARM VALVE.

When the flowage was sufficient to raise the valves, water filled the intermediate space and flowing into the chamber raised the float which closed an electrical circuit by forcing two contact points together.

No rotary gong was shown in the patent drawing although this could readily be installed.

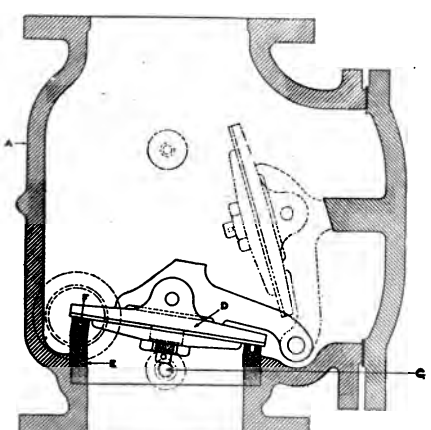
Not generally used so far as known.

Now practically obsolete.

GLOBE OR GARRETT

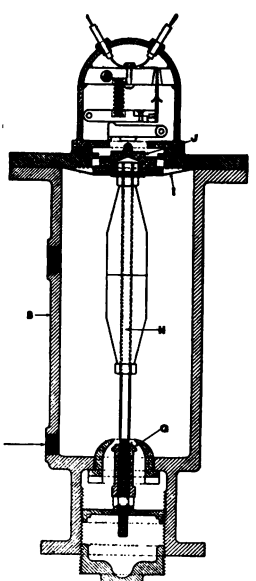
Globe Automatic Sprinkler Co., Cincinnati, O.

This is a swing check seating on a grooved horizontal seat. There is a rubber facing on the clapper to make a tight joint.



GLOBE ALARM VALVE.
(Section.)

A, main casting.
C, outlet from grooved seat.
D, main clapper.
E, valve seat.
F, groove.



GLOBE RETARDING CHAMBER.
(Section.)

I, diaphragm.
M, weighted rod.
D, drip valve.

The pipe from the grooved seat runs to the lower part of a retarding chamber. There is a metal diaphragm at the upper end of the chamber which when it is thrown up, operates a knife switch connected to the electrical circuit. A weighted rod is attached to the diaphragm and at the lower end of this rod is a valve leading to a drip pipe. A $\frac{3}{4}$-inch pipe to the rotary gong connects to the chamber near its upper end.

Water entering the chamber from the grooved seat leaks out through the dip valve until enough pressure has accumulated to throw up the diaphragm. This closes the drip valve and at the same time operates the knife switch on the electrical circuit.

Field experience said to be satisfactory.

Rating: *Not standard. Generally satisfactory.*

GRINNELL ANGLE ALARM VALVE

Made by the *Providence Steam & Gas Pipe Co.*

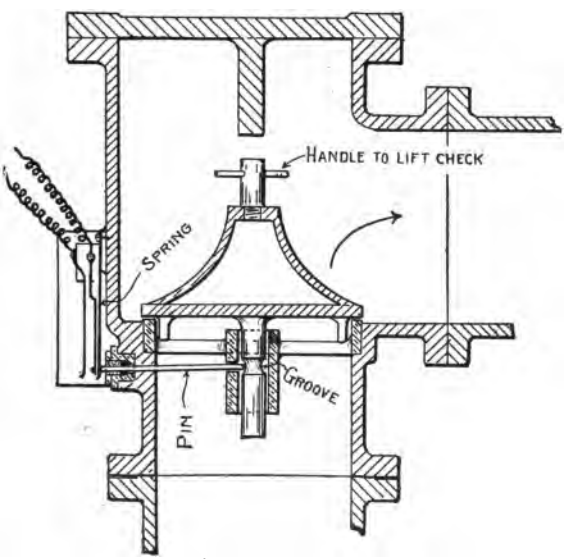
1885. This consisted of a vertical check valve located in a casting which was in the form of an angle. There was a round stem containing a groove attached to the lower side of the check. A pin was inserted in the side of the valve in such a way that one end of the pin rested in the groove of the stem when the valve was closed. When the check was raised by the passage of water, this pin was pushed outwards a short distance by the pressure of the stem below the groove. This motion was utilized to make an electrical connection or to trip a mechanical gong.

A good deal of trouble developed in the course of years from the sticking of the pin for there had to be a stuffing box to make a water-tight joint. Another undesirable feature was the possibility of the pin becoming bent and thus being prevented from moving easily along its guides. These defects were so serious that this type

of valve was finally condemned and most of them have either been taken out or have had the pin removed.

A considerable number were installed. Field experience fairly satisfactory for a few years.

Present rating: *Unreliable. A menace to sprinkler system.*



GRINNELL ANGLE ALARM VALVE.
(Section.)

GRINNELL ENGLISH ALARM VALVE

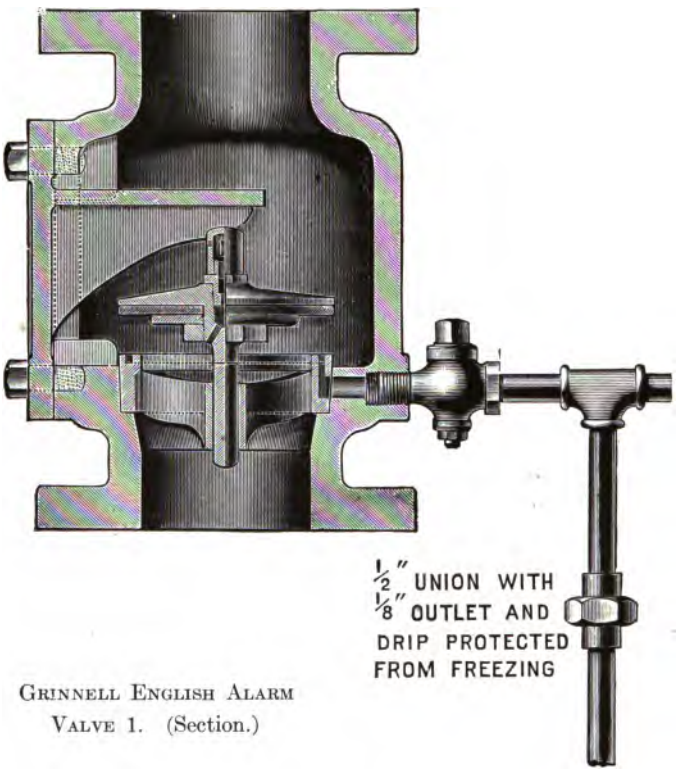
Patented by *Dowson & Taylor.* Manufactured by *Providence Steam & Gas Pipe Co.* Later by the *General Fire Extinguisher Co.*

1–1888. A vertical check valve with a rubber facing seated on a grooved seat. A small auxiliary valve in main check allowed water to pass upwards through the valve but not to return. This tended to create an excess pressure above the valve and thus to prevent false alarms.

Pipe from grooved seat ran direct to rotary gong and circuit closer with no interrupting pot.

But few installed. Now practically obsolete.

Rating: *Subject to false alarms. Unsatisfactory.*



GRINNELL ENGLISH ALARM VALVE 1. (Section.)

2–1890. Similar to No. 1 but with interrupting pot. This pot had a small outlet at the bottom protected by a long vertical strainer. The outlet being smaller than the inlet the pot gradually filled with water when the main check valve was raised and water entered the grooved seat.

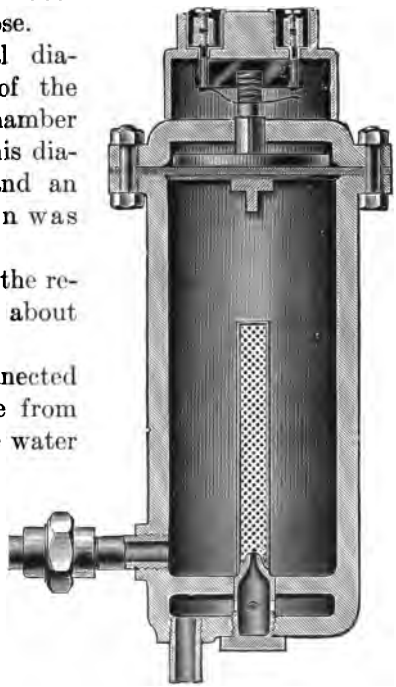
Some of the early types gave trouble from sticking of

the rubber valve at the grooved seat. This was especially the case where the valve was in a warm place or where there was normally a heavy pressure on top of the valve. Later a harder rubber was used for this purpose.

There was a metal diaphragm at the top of the chamber. When the chamber became full of water this diaphragm was raised and an electrical connection was made.

The time element of the retarding chamber was about 20 seconds.

The water rotary connected directly with the pipe from the grooved seat. The water rotary gong consisting of a wheel with paddles like a water wheel was revolved by a stream of water issuing from a nozzle. When the wheel revolved a hinged hammer on the outside of the building was made to strike a large gong.

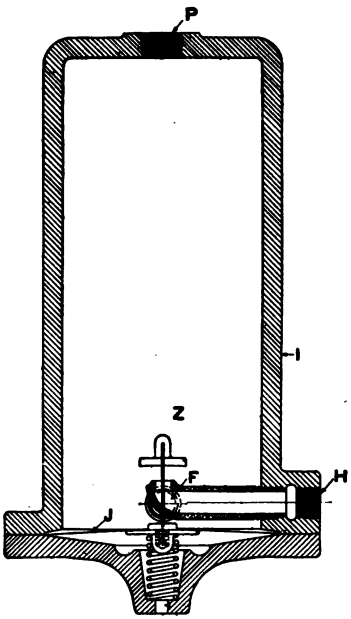


GRINNELL ENGLISH ALARM VALVE 2. RETARDING CHAMBER. (Section.)

A large number were installed. Field experience quite satisfactory though the device was somewhat subject to false alarms. New circuit closers, properly vented, have been installed on some of these old valves to obviate this trouble.

Rating: *Not standard. Fairly satisfactory.*

3–1900. Main valve similar to previous type but without auxiliary check valve. Interrupting chamber and circuit closer redesigned. The outlet pipe from the chamber ended in an elbow pointing up. A valve arranged to close the end of this outlet was attached to a metal diaphragm in the bottom of the chamber. The pipe to the circuit closer and rotary gong connected at the top of the chamber.



GRINNELL ENGLISH ALARM VALVE 3. RETARDING CHAMBER. (Section.)

When the water entered the chamber from the grooved seat it created a pressure on this diaphragm. When the chamber became full, the pressure was sufficient to operate the diaphragm. This pulled down the valve onto the outlet pipe and closed the outlet. The water then flowed to the rotary gong and circuit closer from the top of the chamber.

The circuit closer contained a diaphragm which operated a knife switch.

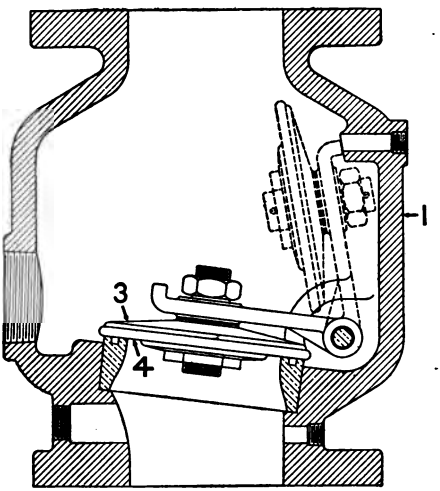
Many of these valves were installed and are still in use. Where properly installed the field experience has been quite satisfactory.

Rating: *Not standard. Generally satisfactory.*

GRINNELL STRAIGHTWAY ALARM VALVE

General Fire Extinguisher Co., Providence, R. I.

1908. Swing check with grooved seat. Capable of being used in upright or horizontal position. A pipe from grooved seat runs to an interrupting chamber of



GRINNELL STRAIGHTWAY ALARM VALVE.
(Section.)

the same design as that used in the No. 3 English Alarm valve. Circuit closer and rotary gong are also of the same design as those in the English Alarm No. 3.

Criticized by the Underwriters' Laboratories in 1907, as follows:

> Somewhat subject to false alarms.
> Susceptible to improper installation.
> Water motor alarm inefficient.

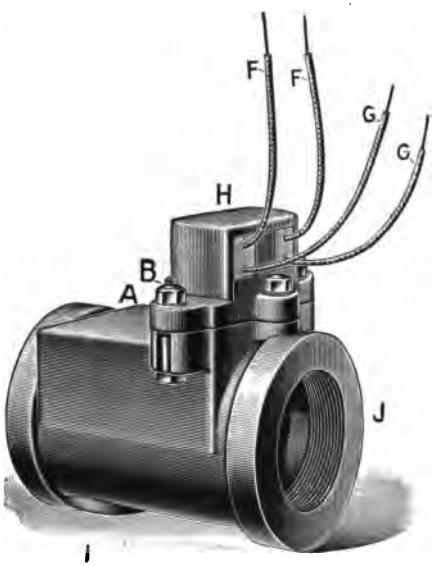
Many of these valves are in use. Where properly installed field experience has been quite satisfactory.

Rating: *Not standard. Generally satisfactory.*

HARKNESS TEE

Made by the *Harkness Fire Extinguisher Co.* Redesigned by the *General Fire Extinguisher Co.*

This was a constant-pressure alarm designed for branch pipes. It consisted of a thin copper flapper supported by a flexible diaphragm. When in its normal position, the flapper closed the water way. In case of flowage it was pushed to one side and this motion transmitted through the flexible tube made an electrical contact outside the pipe.



HARKNESS TEE.
J, main casting. H, circuit closer. F, G, wires to circuit closer.

It was not designed to use with a water rotary gong and could only be used where the water pressure was very constant, as where a tank was the primary supply.

By installing one on the branch pipe feeding each floor

and connecting the wiring to an annunciator, the device would show the floor on which a fire occurred.

Used to a considerable extent in city risks. As redesigned it is being used in connection with supervisory apparatus.

Field experience quite satisfactory.

Rating: *Not standard. Satisfactory under constant pressures only.*

HUNT

Jarvis Hunt, Chicago. Assigned to *Phoenix Fire Extinguisher Co.*

1904. Vertical check valve, hollow and shaped like a truncated cone. It was guided by rods passing through supports above and below the check. Seated on a grooved seat, a pipe from which ran to the atmosphere.

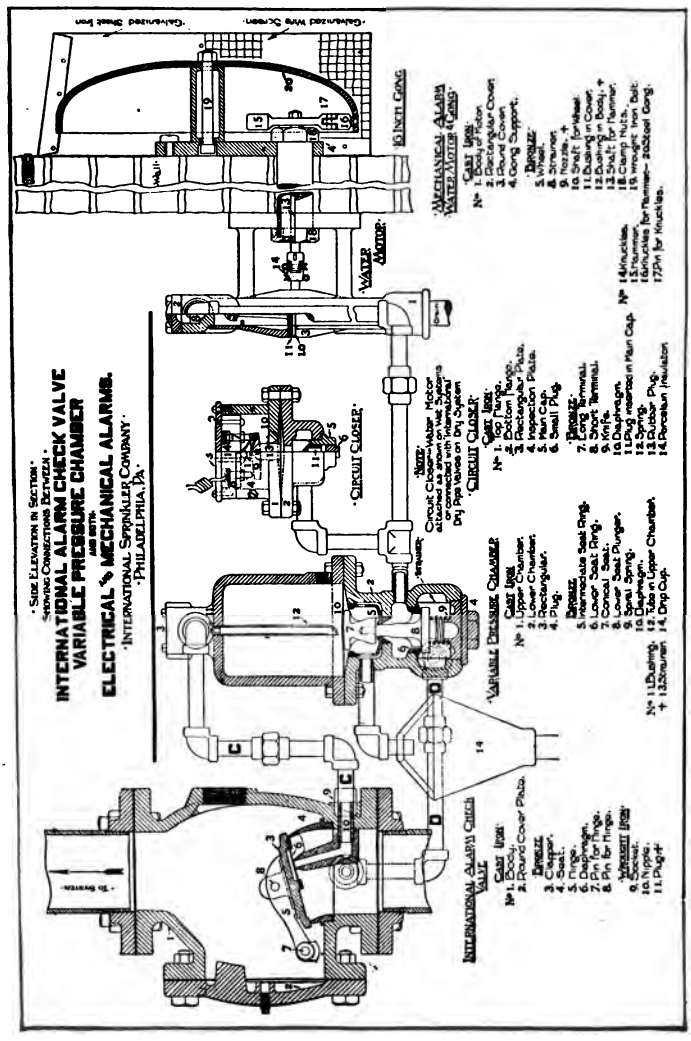
No retarding element or alarm connections shown in the patent drawing. Valve designed to be used either as a differential dry valve or an alarm valve. The buoyancy of the valve was supposed to prevent water columning.

Not used to any extent so far as known.

INTERNATIONAL

Made by *International Sprinkler Co., Philadelphia.*

1901. This company first used an alarm valve of the swing clapper type with a stem extending through a stuffing box. This was soon discarded for the better known " horn " type. This valve was put on the market in 1901 and consisted of a swing check valve seating at a slight angle, designed to be used in either a vertical or horizontal position. A horn, connected to a small pipe, extended through the casing into the water way just below the check valve. When on its seat, the check valve also rested on the end of the horn, thus tightly closing the outlet into the small pipe. There



INTERNATIONAL ALARM VALVE. TYPE C.

was a diaphragm inserted in the lower side of the main check, at the point where the check valve covered the horn. There were perforations in the edge of this diaphragm so as to admit water above it, thus making it easier to adjust the valve so as to give a tight joint both at the main seat and at the horn.

When the check valve was raised off its seat, due to flowage in the system, water entered the horn and flowed to the interrupting pot and finally actuated the alarms.

The interrupting chamber or time element was of an entirely different principle from that in any other valve. It consisted of three compartments, an upper, a middle and a lower one. A valve between the lower and middle compartment was held closed by water pressure coming through a pipe that connected with the riser below the main check and ran to the lower compartment. The small pipe from the horn ran to the upper compartment. There was a thin metal diaphragm at the bottom of the upper compartment separating it from the middle one. The pipe to the alarm devices connected with the middle compartment.

When the alarm valve was closed, no water could enter the horn and there was therefore no pressure in the upper compartment. The water pressure from below the main valve held closed the valve between the middle and lower compartment. There was, therefore, no pressure in the middle compartment.

When the main check valve opened, water entered the horn and flowed from this into the upper compartment. When this became full, the pressure forced down the diaphragm in the bottom of this compartment, thus opening the valve between the middle and lower compartment. The water from the lower pipe then flowed into the middle compartment and thence to the circuit closer, the water rotary gong or both.

This valve was criticized by the Underwriters' Laboratories in 1905 as follows:

1. Variable in action under high and low pressure especially with small water flows.
2. Subject to leakage (through valve).
3. Some parts fragile and susceptible to improper adjustment.

In 1912 they criticized in addition:

1. Liability to false alarms.
2. Reliability doubtful under service pressures of less than 25 pounds.
3. May obstruct flow of water in riser.

A large number of these valves have been installed and the field experience has been generally satisfactory.

There are four types of this valve varying but little from each other. Early types sometimes known as Evans' Alarm Valve.

A–1901. Horn of large diameter ($1\frac{1}{2}$-inch in 6-inch size) with flaring outlet seating on diaphragm in about the center of the clapper. Circuit closer on top of retarding chamber.

B–1902. Horn of smaller diameter ($\frac{3}{16}$-inch) and not flaring as much, seating in center of clapper.

C–1903. Similar to *B* but horn somewhat off center of clapper.

D–1906. Diaphragm discarded and horn seats on an adjustable plug adjusted from upper side of clapper.

Circuit closer connected to pipe running to rotary gong in all but *A*.

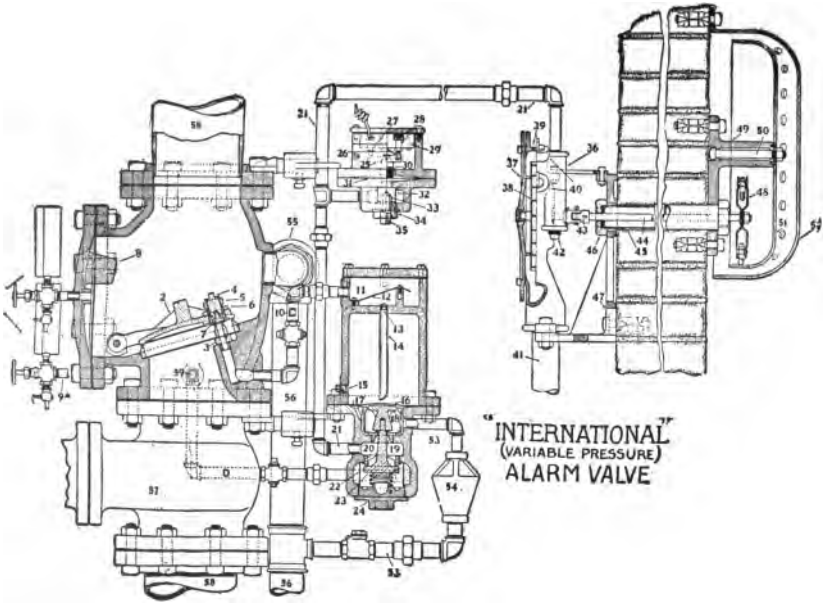
Rating of all types: *Generally satisfactory.*

MANUFACTURERS

Manufacturers Automatic Sprinkler Co. of New York.

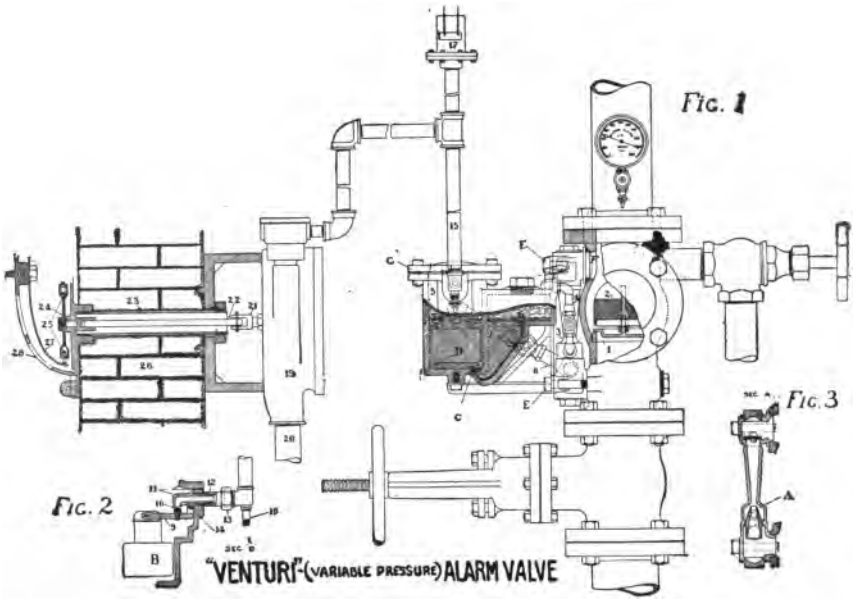
Swing check with packed stem. Subject to false alarms under fluctuating pressures.

Present rating: *Unreliable and menace to sprinkler system.*



TYPE D. DESCRIPTION.

2, clapper.
3, horn.
4, adjustable plug closing end of horn.
10, pipe from horn to upper compartment of retarding pot.
12, strainer.
59, pipe from supply pipe to lower compartment.
21, pipe from middle compartment to circuit closer and rotary gong.
56, drain pipe for sprinkler system.
53, drain pipe from retarding pot.
16, diaphragm containing a small hole 17.
31, diaphragm in circuit closer.
25, switch in circuit closer.
36–50, rotary gong.



VENTURI ALARM VALVE.
(Section.)

1, main clapper.

B, iron float on mercury column.

8, pipe from riser to one side of mercury column.

3, pipe from Venturi throat to other side of mercury column.

10, (Fig. 2) valve opened by dropping of float, thus letting water into pipe 15.

17, circuit closer.

19–28, rotary gong.

Fig. 3. Venturi tube.

A, throat of tube.

VENTURI OR MANUFACTURERS

Submitted to the Underwriters' Laboratories by McNab & Harin Manufacturing Co.

The Venturi alarm valve is made by the Venturi Alarm Co., and installed by the " Automatic " Sprinkler Co. of America.

A–1907. There is a weighted check valve around which there is a small by-pass containing a Venturi tube. This tube, starting with a given diameter at the lower side of the main check, decreases rapidly in diameter until the throat is reached and then increases more gradually to the original diameter. Water passing through such a tube increases in velocity and decreases proportionally in pressure at the throat. This feature is used in an ingenuous way to actuate an alarm-giving device. A double column, or, more correctly, a double chamber of mercury, is arranged with a heavy iron float on one side of the column. When in its normal position, this float holds closed a valve on the end of a pipe leading to the circuit closer and rotary gong. There is one pipe running from the riser below the main check valve to the float side of the mercury column and another pipe running from the throat of the Venturi tube to the other side of the column. When the system is in normal condition, the mercury is at the same level in each side of the column and the valve on the pipe to the gongs is closed. When water begins to flow in the riser, it causes a flow through the Venturi tube. The pressure at the throat of the tube is decreased and this decrease is transmitted to one side of the mercury column. The float therefore falls and opens the small valve to the gongs.

This type of valve has been used quite successfully for several years. One feature that is apt to cause trouble and which must be carefully watched is the wedging open of the main check valve which might

cause a failure of the alarm to operate and still would give no trouble alarm. In case a small stick, stone or other obstruction should lodge on the seat of the check and hold it open no alarm or trouble signal would probably be given. In case a sprinkler opened, the water to feed it would flow through the main check instead of through the Venturi by-pass. In other types of valves the wedging open of the check valve in this way will cause a continuous alarm until the trouble is remedied and no failure in case of fire would result.

To reduce the possibility of such trouble to a minimum a quarter-inch test pipe is installed just above the main check. This can be used to make a final test after there has been a flowage of water through the system. If the alarms will operate with this quarter-inch test pipe open, it is safe to assume that the main check is on its seat or at least there is not enough obstruction under it to cause trouble.

Another feature which is liable to cause trouble is the possible leakage of mercury at the gage joints, although this has now been well guarded against.

The time element in this valve depends upon the size of the orifice through which the mercury has to pass in flowing from one chamber to the other. This orifice is wedge shaped so that the mercury flows back a little faster than it flows in.

Reported upon by the Underwriters' Laboratories in 1909. Features criticized:

1. Unreliability of alarm at rates of flow around 300 gallons per minute.
2. Danger of clogging of mercury column.
3. Danger of mercury leakage.
4. Susceptibility to misadjustment.
5. Effects of water eddies at inlet.
6. Inaccessibility of main valve seat.
7. Liability of failure to send in alarm if check is not tightly seated.

In June, 1912, the following criticism was also made.

Liability to false alarms.

A large number have been installed and field experience has been generally satisfactory where properly installed and adjusted.

Rating: *Not standard. Generally satisfactory.*

B–1910. Similar to *A* but with main check valve seating at an angle and Venturi tube in a vertical position. There is less liability of this device being improperly set up.

Rating: *Not standard. Generally satisfactory.*

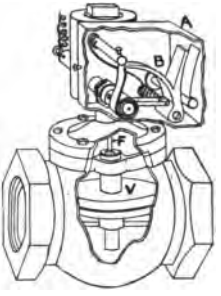
NEU

Gustave S. Neu, New York City.

Installed by the Walworth Manufacturing Co. and other sprinkler concerns.

This consisted of a vertical check valve seating on a horizontal valve seat in much the same way as the disc of a Globe shut-off valve.

There was a spindle on the lower side running in an interior guide supported by two arms. On the upper side was another spindle carrying a small plunger which ran through a stuffing box to a metal casing attached to the top of the valve. In this casing were two contact points which were brought together when the plunger was thrown up by the opening of the check valve, thus closing an electric circuit and ringing a bell.



NEU ALARM VALVE.
(Part in section.)
V, valve clapper.
F, spindle.
A, contact case.
B, contact points.

This device had no provision for a water rotary alarm. It was subject to sticking at the stuffing box.

It was used to a considerable extent about 1895.

Reported upon by Underwriters' Laboratories in 1905. All features criticized.

Rating: *Unreliable. A menace to sprinkler system.*

NIAGARA

Niagara Fire Extinguisher Co., Akron, Ohio.

This was a swing-check valve with a weighted clapper seating on a phosphor bronze seat ring. The arm carrying the clapper was keyed to a rod which passed through the casing and actuated the alarm device on the outside. The rod or stem was rotated as the clapper opened or closed. Instead of a stuffing box at the point where the stem passed through the casing, as was customary in old valves of this type, a flexible ground joint was used. This consisted of a ring attached to a metal diaphragm bearing on a ground plate. The water pressure in the system acting on the diaphragm caused a pressure on this ground joint which kept it tight.

Not used to any extent so far as known.

Present rating: *Unreliable.*

ROCKWOOD

Worcester Fire Extinguisher Co. Later *Rockwood Sprinkler Co.*

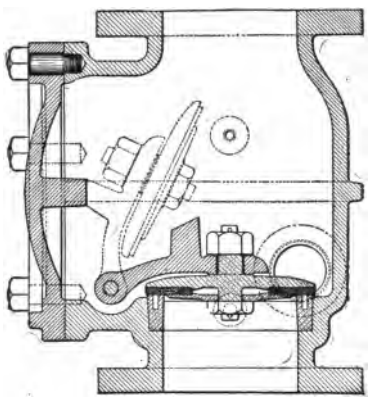
1–1906. This was built on the same lines as the Grinnell English pattern No. 3. The main valve was a vertical check with rubber seat. The retarding chamber had a valve at the end of the outlet pipe closed by the movement of a metal diaphragm.

But very few valves of this type were installed and the retarding chambers have now all been replaced.

Rating: *Obsolete.*

A–1909. Similar to No. 1, except a swing check was used. Retarding chamber redesigned. The pipe from

the grooved seat entered the base of the retarding chamber through a screen. Taking a sharp curve it flowed through a Venturi tube into the chamber proper. A small drip ran from the throat of the Venturi tube to



ROCKWOOD ALARM VALVE A.
(Section.)

a drip pipe. This acted as a drain for the entire retarding chamber.

In case of water hammer the water from the grooved seat would not fill the chamber and would quickly drain out. In any case there would be a constant flowage from the drip pipe while the main check was off its seat.

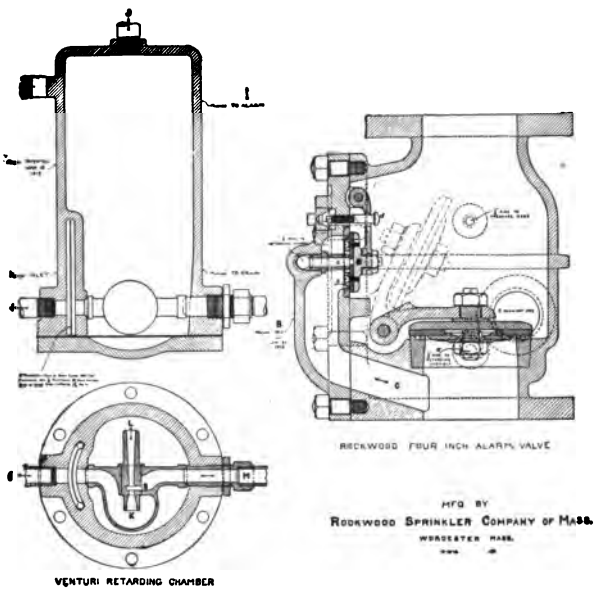
This valve was installed to a considerable extent and gave fairly good results. Somewhat subject to failure of rotary under light pressures.

Rating: *Not standard. Generally satisfactory.*

B–1911. Main valve redesigned. Same retarding chamber as in *A*.

Main valve consists of a swing check seating on a horizontal grooved seat. Designed for a vertical position only. There is a small by-pass ($1\frac{1}{2}$-inch on 4-inch size) around the main check with a swing check at the upper

end. This check closes on the open end of the by-pass. A ½-inch pipe runs from the small by-pass to the retarding chamber connecting with the pipe from the main check just outside the chamber. This by-pass is



ROCKWOOD ALARM VALVE TYPE B.

Section of valve on right. Sections of retarding chamber on left. C, by-pass around main check. B, auxiliary valve in by-pass.

designed to take care of small flows and water hammer so that the main valve will not open frequently.

This valve is being extensively installed and is giving fairly good satisfaction.

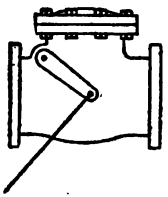
Rating: *Not standard. Generally satisfactory.*

WALWORTH

Walworth Manufacturing Co., Boston.

This was a swing check with lever attached to check passing through stuffing box to outside of the casing.

ROCKWOOD ALARM VALVE.
Exterior view showing retarding chamber, etc.



WALWORTH ALARM VALVE.

The movement of the lever, when the check opened, tripped a mechanical gong. No water rotary could be used with this valve.

Used to considerable extent. Now practically obsolete.

Field experience unsatisfactory. Subject to false alarms and sticking at the packed stem.

Rating: *Unreliable and a menace to system.*

Note: In late equipments the Walworth Co. used the Grinnell English type valve to some extent.

CHAPTER II

DRY SYSTEMS AND DRY VALVES

DRY SYSTEMS. GENERAL FEATURES

A dry-pipe system is one in which there is air under pressure, instead of water, in the sprinkler pipes.

These systems are needed in buildings which are not sufficiently heated to prevent freezing in winter. They are never considered quite as effective as wet-pipe systems as they are slower in action, more complicated and more likely to cause interruptions in the sprinkler service.

A dry-pipe system is installed in a similar manner to a wet-pipe system except that more care is necessary in arranging all parts to drain properly and, on account of the increased difficulty of holding air under pressure, extra precaution should be taken to make all joints as tight as possible. A dry valve is installed in the system, usually inside the building at the lowest level, and when the system is in normal condition there is no water in the pipes above this point.

DRY VALVES

A dry-pipe valve is a device for holding back the water in a sprinkler system until fire occurs and then opening automatically and allowing the water to flow into the pipes. Air is pumped into the pipes above the dry valve and the pressure thus created holds the valve closed. These valves are always designed so a moderate amount of air pressure will hold back a much heavier water pressure. This is done for two reasons: first, because a heavy air pressure is difficult to pump up and

hard to maintain; second, because the time necessary to exhaust a heavy air pressure and the fanning effect on the fire of the escaping air both act against the quick control of a fire.

Several different types of dry valves have been invented but those in use today are of two types, the differential and the mechanical. In the differential type there is a double-seated check valve, the upper or air seat being much larger than the lower or water seat. The difference in area between these two seats determines the differential or difference in pressure necessary to balance the valve. Valves of this type are generally designed with a differential of about 7 to 1, that is one pound of air pressure on the upper side will just hold the valve closed against 7 pounds water pressure on the lower side. Examples: Grinnell and Rockwood.

In the mechanical type the check on the water side is held closed by a system of levers, these being held in place by the action of air pressure in the pipes. Here there is generally no fixed ratio of air and water pressure that will hold the valve closed but the valve is designed to open at a predetermined air pressure which, however, can be somewhat varied by the amount of pressure exerted on the adjusting screw. Examples: International, Manufacturers and Niagara.

All types of dry valves are subject to "water columning" if not properly installed and maintained. In other words if there is enough water in the pipes above the valve to produce a pressure on the valve greater than the pressure at which it will trip, then the valve is "columned" and will not open automatically. If, for instance, in a differential valve, having a differential of 6 to 1 and a water pressure of 30 pounds in the supply pipe, enough water should accumulate above the valve to make a column 12 feet high, the pressure of this water, namely a little over 5 pounds (0.43 pound to each foot),

would be more than one-sixth of the water pressure and would therefore hold the valve closed. This water pressure, unlike air pressure, is not reduced when a sprinkler head at a higher level opens. This feature gives little trouble in practice however.

Water accumulates above a valve in two ways: first, by slowly draining from the small end pipes which will not drain quickly when the main draw-off pipe is open owing to the vacuum action; second, by the condensation of water from the air which is pumped into the pipes.

Water collecting in the pipe above a dry valve may also cause trouble by freezing where the pipe is exposed. It is therefore of vital importance that the draw-off pipe above the dry valve be opened occasionally to drain off any water that may have collected.

It is essential that the intermediate space between the air and water valves in a differential dry valve be kept free from water. Should water leaking past the water valve fill this space under a pressure greater than the air pressure, the air valve would be opened and the system flooded. In all systems having a closed intermediate space this feature is safeguarded by an automatic drip. This drip takes care of any small leakage but closes automatically under the pressure resulting from the opening of the valve.

Operation. The general operation of dry systems is as follows. The system is set up by closing the main gate valve and draining off all the water above the dry valve. The dry valve is then set up and air pressure is pumped into the pipes. When the pressure has reached a sufficient amount to hold the dry valve closed, the gate valve is opened and the water pressure rests on the lower side of the dry valve. When a sprinkler opens, the air pressure in the pipes escapes until the tripping point is reached, when the dry valve is forced open by the water pressure thus allowing the water to flow into the pipes.

Maintenance. A dry system is much more difficult to maintain than a wet system because the air in the pipes is certain to leak out slowly, thus necessitating more or less frequent pumping. Unless the system is carefully watched and cared for the valve is liable to trip and flood the pipes. This would do no damage in warm weather, but in freezing weather great damage would probably result from frozen pipes.

The air pressure maintained should vary only between small limits, for too high a pressure will retard the action of the system and too low a pressure may allow the valve to trip. In a differential valve, with a ratio of 7 to 1 and with a water pressure of 80 pounds, the tripping point is about 12 pounds and the air pressure should range from 20 to 30 pounds. With a lower water pressure these figures could be somewhat reduced and with higher pressure they should be increased. In a valve of the mechanical type the air pressure should be between 30 and 40 pounds regardless of the water pressure.

NATIONAL BOARD RULES FOR DRY SYSTEMS

The rules of the National Board of Fire Underwriters for dry-pipe valves and fittings (Sec. H) state that dry-pipe systems should be used only where wet-pipe systems are impractical, and while not as desirable as wet-pipe systems they are far preferable to shutting off the water supply in cold weather.

Air pressure should be maintained on the system the entire year, except by special consent. This is required because the draining and filling of the system every year tends to cause corrosion in the pipes and frequently brings in dirt and sediment. Then again the Assured usually take better care of a system that is maintained dry the entire year. When water is admitted in the spring there is a strong temptation to neglect the system

during the summer and not to drain it and pump up the air until cold weather has already caused damage. Another undesirable feature is that when the water is in the dry system, all automatic alarm attachments must be shut off to prevent them from ringing continuously. Therefore, unless an alarm valve is also installed in the pipe, the alarm service must be sacrificed.

On the other hand it cannot be denied that a system with water in the pipes is somewhat quicker and more reliable in action (except for the alarm feature), for at best it takes an appreciable time for the water to reach a sprinkler after it has opened and dry valves are not infallible in their action. It is therefore occasionally wise to waive this rule. This is especially the case in new systems that are not perfectly tight, for by letting water remain in the pipes during the first summer, small leaks are frequently closed by corrosion and the system made much tighter. It is also questionable whether it is not wise to run the dry systems wet during the summer in the southern states where freezing weather lasts only about two months out of the twelve. The Factory Mutual Insurance Companies do not have this restriction in their rules. In fact they prefer to have water let into the system each spring and usually require a full-sized by-pass around the dry valve for this purpose. The gate valve in this by-pass is kept open during warm weather.

Drainage. Sprinklers on a dry system should always be installed in an upright position so that they will drain properly. Great care should be taken to arrange all piping to drain thoroughly and if possible to drain to one drip pipe located just above the dry valve.

The horizontal pipes should have a greater pitch than those in a wet-pipe system, namely, not less than $\frac{1}{2}$ inch in 10 feet, so that the pipes will drain more rapidly and thoroughly.

Supplies. All water supplies must be brought together below the dry valve so that they will feed the sprinklers through the valve.

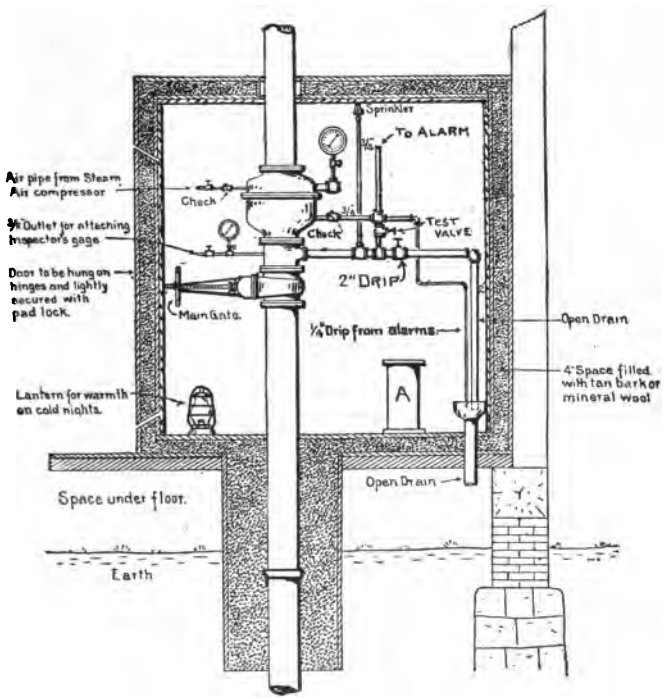
Size of Systems. The number of sprinklers on one dry system is limited to 500 sprinkler heads, preferably not over 300. The larger the system the longer it will take for water to reach a head after it has operated, because of the larger amount of air to be exhausted. In a system installed in a grain elevator some years ago there were about 1500 heads on one 6-inch dry valve and an actual test showed that it would take the water four minutes to reach a head 150 feet above the valve. Most of this time was taken in reducing the air pressure through one open head to a point that would allow the valve to trip. In a system installed under the present rules it should not take more than 20 to 40 seconds for the water to reach any head after it has opened.

Where more than one valve is needed in a building the system should be divided horizontally instead of vertically. In other words the basement, first and second floors might be on one valve and the third, fourth and fifth floors on another valve. If the system were divided vertically with half of each floor on one valve and the other half on the other valve, a fire starting near the center of a floor might open heads on one system and then spread to the section controlled by the other valve. This would necessitate the operation of the other dry valve, with the resulting delay, at a time when any delay might be quite serious. Where the systems are divided by fire walls this rule would not apply.

Air-filling Pipe. An air pump is necessary to pump air into the system. The connection from the air pump to the system should be made at the dry valve and there should be a shut-off and check valve in the air pipe close to the system. The check valve prevents the air in the system from leaking out through the air pump or

through any break that might occur in the air pipe behind the check.

Enclosure of Valve. The dry valve should be so located that it will not freeze. If in a cold building, it can either be in a pit or else in a frostproof closet. In any case the enclosure should be of sufficient size to give $2\frac{1}{2}$ feet on all sides of the valve. The closet can be



DRY VALVE CLOSET.
A, flanged dummy.

heated with steam, gas, electricity or a lard oil lantern. A sprinkler, connected to the main riser below the dry valve, should be located in the closet.

Test Pipes. A 2-inch test pipe is now required on the riser just below the dry valve so that the water

supply can be thoroughly tested. This is in addition to the drain pipe above the dry valve. This is of great importance for without it no adequate test can be made to prove that water in proper volume is in the pipes up to the dry valve.

Air Compressor. An air compressor or air pump should be provided of sufficient capacity to increase the air pressure in the system at least one pound in two minutes. With such a pump, it should not take over 60 minutes to pump up a system. With some of the pumps formerly furnished, it often took a day to do this and during the interval the system was out of commission. Steam or electrically driven pumps are preferable to power pumps as they are more reliable.

The air pump should draw its supply from some place where the air is dry and not too warm. Unless this is done, moisture-laden air, which will condense and may cause trouble, will be pumped into the pipes. It is often desirable to take the air from out of doors. A very good plan is to draw the air through a reservoir or tank of about 30 gallons capacity containing 10 to 15 pounds of granulated calcium chloride which absorbs the moisture and leaves the air very dry. The end of the suction pipe should be screened to prevent drawing in any foreign material.

Auxiliary Dry System. Where the larger part of a sprinkler system must be dry, it is desirable to pipe the entire equipment on the dry system; but where less than 25 per cent must be dry, a separate dry valve should be installed to control this section, and the rest of the system should be wet pipe. Show windows and stair towers come under this heading. There is always a temptation to shut off the sprinklers in such places during cold weather, but this is undesirable and should only be done in extreme cases and with the consent of the inspection department having jurisdiction. It is

particularly important to keep the sprinklers in show windows in commission at all times as there is considerable hazard there, especially at Christmas time, and a number of fires have been caused by the elaborate illumination installed in these windows.

In order to save the expense of a dry valve it is sometimes feasible to use an ordinary check valve, pumping up a heavy air pressure above it. This should only be done where there are but few heads involved and where the water supply is of steady and not of too heavy pressure. The air pressure must considerably exceed the water pressure in such a case but the time necessary for the water to reach a head is not excessive as the volume of air to be exhausted is small. The check valve like a dry valve should be primed with water to make it tight.

Flanged Dummy. A flanged dummy, or section of pipe of the same length as the dry valve, is required with each dry system. This is to be used to replace the dry valve in case the latter has to be sent away for repairs. If the repairs are made in mild weather the water can then be kept on the system until the valve has been replaced.

EARLY SYSTEMS

One of the first attempts to prevent freezing in a sprinkler system was in 1861 when *Osmund Williams* patented a non-freezing chemical solution to be used in sprinkler pipes. The *Harkness* system also used a similar solution.

In 1864 *Wm. Gilbert, Edwin Cooper* and *G. R. Webster* made a fusible cord of gutta percha, chloride of sulphur, sulphuret of antimony, copper bronze and naphtha. This melted at from 90° to 120° F. and was arranged so that when it fused it would release the hammer of an alarm and also open the water valve on a sprinkler supply pipe.

John W. Bishop of New Haven suggested a dry-pipe valve in 1879 and took out patents in 1881. This consisted of a vertically rising valve closing the water port. A stem on the upper side of the valve was clamped to an elastic diaphragm of a much larger area than the water valve. Water was allowed to enter the system above the diaphragm to a sufficient height to hold the valve closed by pressing on the upper side of the diaphragm. There was a by-pass containing a cock normally closed, extending from below the water valve to the space under the diaphragm.

A system of cords containing fusible links at short intervals was strung along the ceiling near the sprinklers and so arranged that when any link melted, a weighted lever connected to the cock was released. This opened the cock in the by-pass and allowed water pressure to enter the space under the diaphragm. This counteracted the pressure above the diaphragm and allowed the water pressure in the main pipe to open the water valve.

Another early system was the *Mackey*, installed by J. C. Mackey of Syracuse, N. Y., in conjunction with the sprinkler head of the same name. In this system a gate valve normally closed and with a weighted arm kept the water out of the system, no air pressure being used. There was an auxiliary thermostat system installed with a thermostat near each sprinkler. The weighted arm of the valve was held by an electrically operated tripping device connected to the thermostat system.

In case of fire a sprinkler opened and the thermostat near it also operated. This closed an electrical circuit through an electro-magnet and tripped the weighted arm. The valve was thereby opened and water allowed to enter the system.

Mr. Frederick Grinnell took out his first patent on a

dry valve in 1879. This consisted of a horizontal check valve seating vertically and with a stem running in guides. A system of levers was used to hold this valve securely closed. A small diaphragm in the lower part of the casting acted on a rod which was arranged to trip the levers. Air pressure pumped into the pipes above the check valve held this diaphragm down. When the air pressure was released the diaphragm, actuated by a weighted lever or spring, was forced up and this motion tripped the levers and allowed the valve to open. This valve was self-contained, except for an alarm attachment, and was far superior in principle to many that succeeded it.

The alarm connection consisted of a lever attached to the water valve and extending through a stuffing box to the outside. The movement of the check valve was used to trip a mechanical gong.

The first valve to be generally used was the Grinnell differential " bellows type " invented in 1885. The differential valve No. 12 which succeeded it in 1890 was very widely used — perhaps more so than any other valve, and the field experience was remarkably successful.

Amongst the other early dry systems was the *Gray*, first patented in 1884. This used an auxiliary system of pipes for the air pressure and was quite extensively installed. Mr. Gray patented seven other dry-pipe valves and systems between 1884 and 1902 but most of them had very limited use.

The Walworth Manufacturing Co. installed a limited number of dry systems but their valves were cumbersome and unreliable and they preferred to install wet-pipe equipments.

Many of the older valves were very unreliable and but few that have been in use for over twenty years can be considered efficient today. The valves made today

are very reliable when properly installed and carefully maintained. They all require careful supervision to see that water is kept drained from the pipes and sufficient air pressure maintained at all times.

REQUIREMENTS FOR DRY VALVES

The following are the more important general requirements which an approved dry valve should fulfill although a valve fulfilling them all is not necessarily satisfactory.

Should be strong and simple in design and construction and capable of withstanding 300 pounds pressure.

Should not cause excessive loss of hydraulic head.

Should not depend upon delicate adjustments and should not be subject to misadjustments as a result of wear, repair or reassembling.

Should have all working parts enclosed.

Should not be easily affected by corrosion, mud or pipe scale.

Should have an opening action giving direct relief to water valve.

Should not have an opening action traversing a pressure-retaining joint or fit.

Should trip between 6 and 14 pounds air pressure under service pressures between 50 and 120 pounds.

Should not trip from normal leakage at air or water seat; or if water pressure is entirely removed.

Should not have intermittent action after opening.

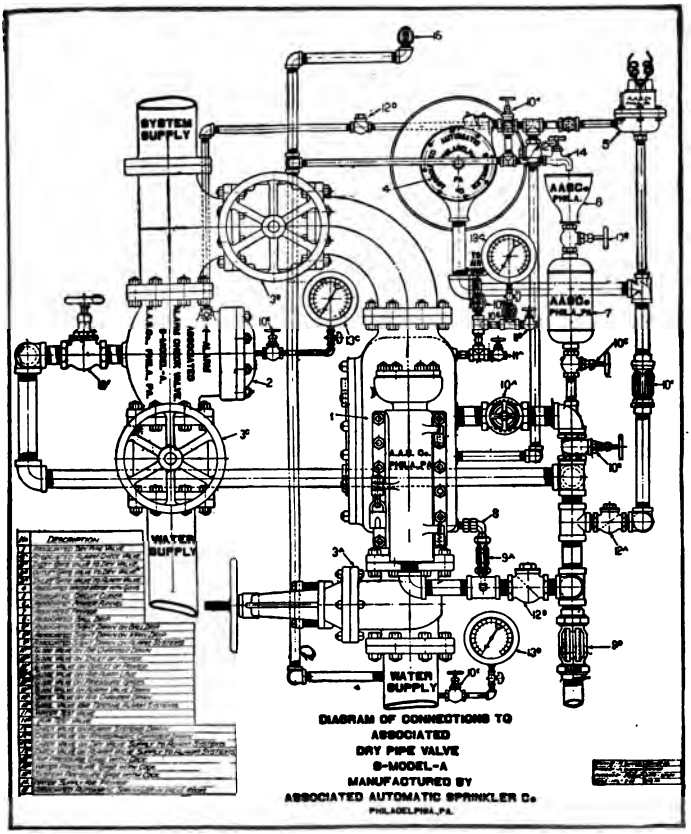
Design should be such that valve can be located close to a wall, floor or ceiling; is easy to repair or adjust; will not spill water when it operates; cannot be set unless correctly assembled; is not easily gagged; is not readily water columned; air pressure seats not likely to require regrinding.

ALPHABETICAL LIST OF DRY VALVES

ASSOCIATED

Manufactured by *Associated Automatic Sprinkler Co., Philadelphia, Pa.*

Details not yet made public.



BROWN

Manufactured by the *Automatic Fire Alarm & Extinguisher Co., New York.*

Mechanical valve. Opinion of the Device and Material Committee of the National Fire Protection Association, November, 1904.

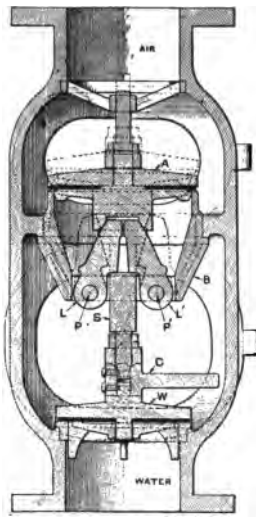
1. Liable to be inoperative under ordinary service conditions.
2. Has opening action failing to give direct relief to water valve.
3. Has opening action traversing a pressure-retaining joint or fit.
4. Working parts not satisfactorily enclosed.

Present rating: *Unreliable.*

CATARACT

Automatic Sprinkler Equipment Co., Chicago, Ill.

1905. This was a valve of simple construction and of the mechanical type. There were two vertical clappers seating on horizontal valve seats with an intermediate space between. The lower or water clapper was held closed by a stem bearing against two hinged levers forming a toggle joint. The upper ends of these levers rested in a cup-shaped depression in the base of the upper or air valve. The leverage was such as to cause the valve to trip at very low air pressure: namely, 2 pounds air under 44 pounds water, and 5 pounds air under about 85 pounds water.



CATARACT DRY VALVE. (Section.)

A, air clapper.
W, water clapper.
S, stem.
L, levers.

Criticized by the Underwriters' Laboratories in February, 1907, as follows:

1. Low trip point.
2. Adjusting mechanism for water valve.
3. Friction loss.
4. Effects of corrosion.
5. Features of design and construction.

Third sample, October, 1907, criticized by Underwriters' Laboratories as follows:

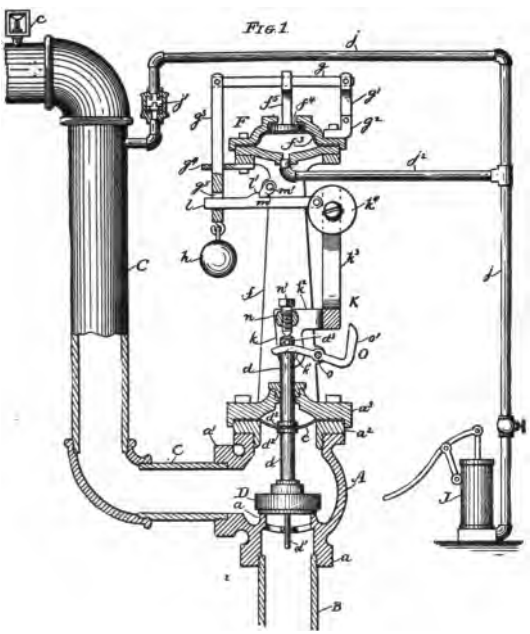
Effects of compression screw on trip point renders valve liable to water column on low pressures and necessitates excessive air pressures on high-service pressures.

Rating: *Unreliable.*

CLAPP

Made by *Clapp Automatic Fire Extinguisher Co., Chicago.*

1–1890. Mechanical type. Angle valve with water clapper seating horizontally. Stem on upper side of water valve passed through top of casing, a tight joint



CLAPP DRY VALVE 1.
(Part section.)
D, water clapper. *d*, stem. *e*, diaphragm. *g*, *m*, *k*, levers.
f^3, tripping diaphragm.

being made by use of a flexible diaphragm. Stem held down by a system of levers. When the air pressure dropped, a diaphragm normally held up by the air pressure fell, thus allowing a weighted lever to drop and trip the levers. There was no air check and the air pressure rested on the upper side of the water valve.

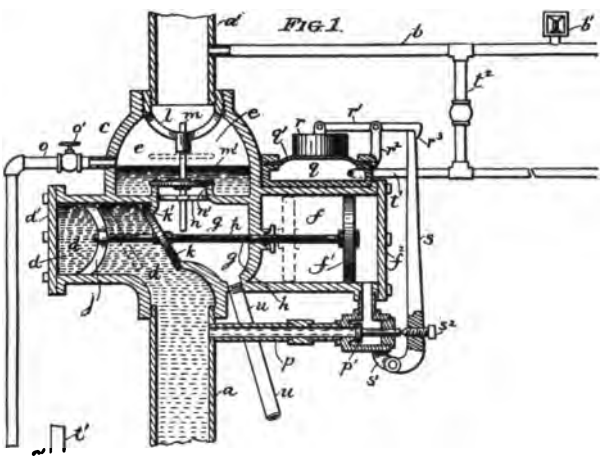
But few were made.

Opinion of the Device and Material Committee of the National Fire Protection Association, 1904:

1. Liable to be inoperative under ordinary service conditions.
2. Easily affected by exterior corrosion.
3. Operating action does not give direct relief to water valve.

Present rating: *Unreliable.*

2–1891. Piston type. Angle valve with vertical air check, and horizontal water valve opening against water



CLAPP DRY VALVE A.
(Section.)

k, water clapper. *f*, piston. m^1, air clapper. *p*, by-pass to space behind piston. p^1, valve in by-pass. *q*, diaphragm. *r*, *s*, levers tripping valve in by-pass.

pressure. There was a piston of slightly larger area than the water valve connected to the valve by a rod. The sprinkler supply pipe entered the device between the water valve and the piston. A by-pass admitted water pressure to the further side of the piston and as the pressure was balanced on each side of the piston, the water pressure held the main valve closed. When the air

pressure was released, a diaphragm connected to a weighted lever was allowed to drop. This lever opened a drip pipe in the space back of the piston thus releasing the pressure there. The water pressure acting with more force on the piston than on the valve pushed the piston back and opened the valve. Made up to 1893.

Underwriters' Laboratories Report, 1903:

Thirteen features criticized.

Present rating: *Unreliable.*

Note: A slight modification of this valve is shown in Cut A.

CLAYTON

Ernest S. Clayton, Newark, N. J. Made by Independent Fire Extinguisher Co., Newark, N. J.

1906. This was a differential valve of the balanced type. It consisted of two valve discs held together by a rod, the upper disc being somewhat larger than the lower one. The water entered an intermediate space between the two discs and held them up, the pressure being greater on the upper disc. There was a small water way through the upper disc closed by a loose stopper held in place by a diaphragm. The air pressure in the system ordinarily held the stopper in the opening. When the air pressure was reduced the stopper was released and water entered the chamber above the valve. This created an equal pressure on the upper and lower sides of the upper disc, and the water pressure acting on the lower disc (then unbalanced) opened the valve.

Underwriters' Laboratories Report, May, 1907.

Features criticized:

1. General principle of operation.
2. Necessity of delicate adjustment.
3. Danger of water columning by leaking at water seat.
4. Delay in action.
5. Features of design and construction.

Never used so far as known.

Present rating: *Unreliable.*

CROWDER

Crowder Bros., St. Louis, Mo.

1–1907. Mechanical valve. Large casting with swing check valve for air seat and a similar check for water seat, both seating horizontally. The water check held in place by a series of external and internal levers and weights was tripped by the release of air pressure in a small air pot.

Underwriters' Laboratories Reports, January, 1907, and September, 1911.

Various criticisms.

2–1913. Modified form. Features criticized:

1. Ease of gagging.
2. Improper safeguard against leaving intermediate chamber open.
3. Failure to open.
4. Trip or operating point.
5. Effects of corrosion.
6. Other features of design and construction.

Never used so far as known.

Rating: *Unreliable.*

DIXON

J. H. Dixon, Erie, Pa.

Underwriters' Laboratories Report, 1904, on undeveloped device.

Practically all features criticized.

Never used so far as known.

DODGE

Dodge Manufacturing Co., Mishauwaka, Ind.

Mechanical valve. Water clapper was held in place by a system of levers and an inverted auxiliary air clapper. When the air pressure was released the air

clapper dropped, thus releasing a weighted lever connected with the water clapper.

Underwriters' Laboratories Report, April, 1903. 6 features criticized.

March, 1904. One feature criticized.

Never used so far as known.

GLOBE OR GARRETT

C. B. Garrett, Minneapolis, Minn. Assigned to *Globe Automatic Sprinkler Co.*

A–1906. Mechanical valve with two clappers. Upper or air clapper seated at an angle of about 45 degrees. Lower or water seat was horizontal. Lower clapper held in place by a long hinged lever bearing against upper clapper.

Several laboratory reports between July, 1910, and February, 1913.

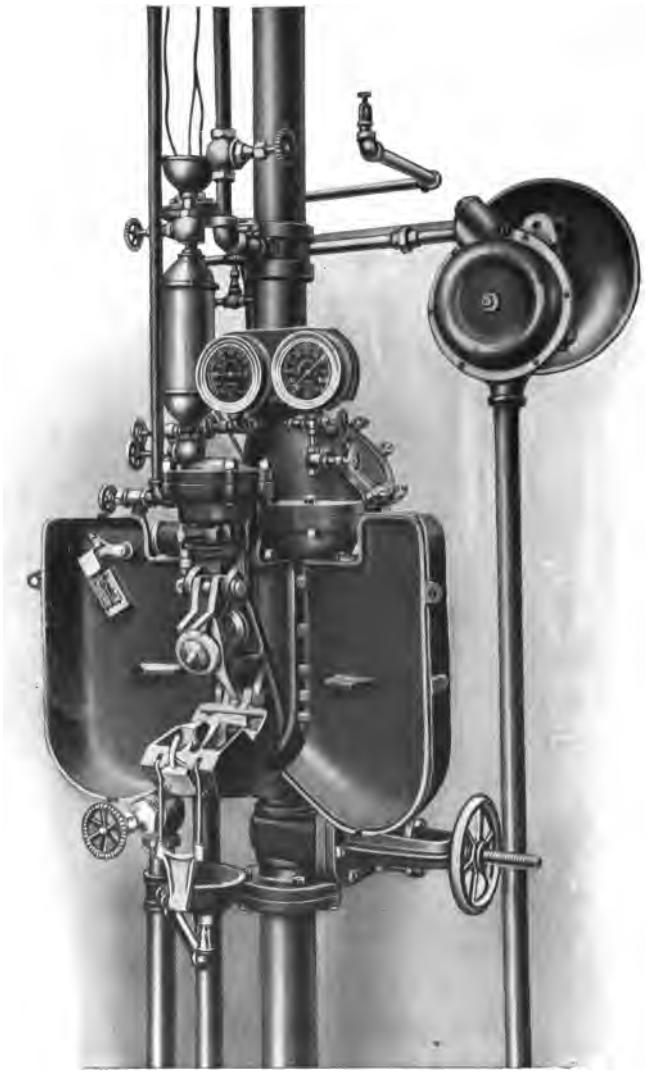
B–1913. This consists of a casting containing an air and a water clapper. There is also an auxiliary air check located in an offset. The main water clapper is held closed by a system of levers connected to the auxiliary air check.

Criticized by the Underwriters' Laboratories in August, 1913, as follows:

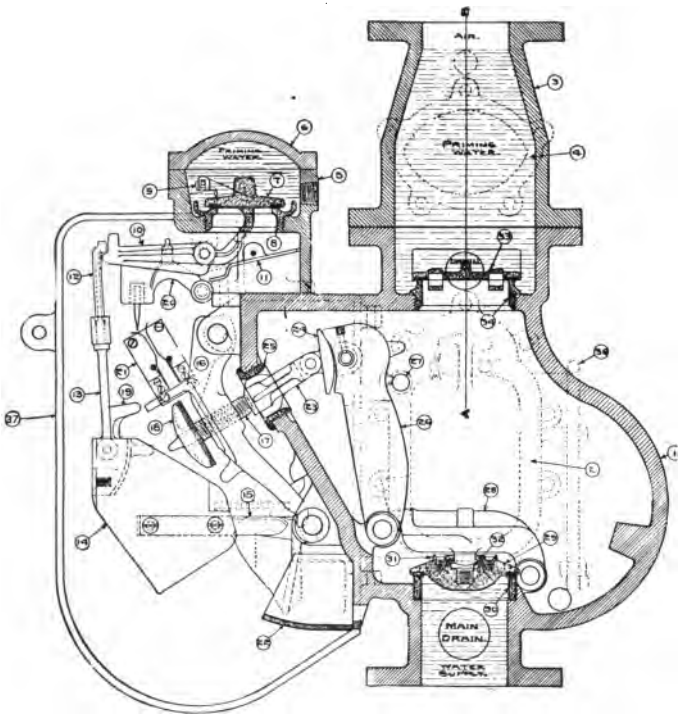
1. Strength of parts.
2. Erratic action of parts.
3. Ease of gagging.
4. Liability of improper adjustment of parts and other features of design and construction.

Description. 29, water clapper. 33, air clapper. 7, air pot clapper. 28, compression lever. 26, 23, 16, 15, 14, 13, 12, 10, levers holding air clapper in place.

Rating: *Not standard.*



GLOBE DRY VALVE.
Interior View. Tripped.



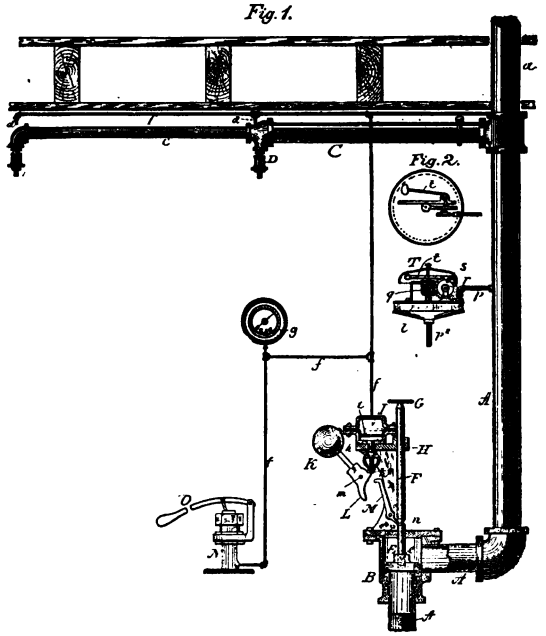
GLOBE DRY VALVE.
(Section.)
See description, page 197.

GRAY

Manufactured by *Gray Sprinkler Co., New York.* Installed by *Insurers Automatic Fire Extinguisher Co., New York.*

1–1884. Mr. Frank Gray of New York patented a dry-pipe system in 1884 in which an auxiliary system of small piping was used for the air pipes. This piping was run parallel and close to the sprinkler piping and small fusible plugs were inserted in this piping near each sprinkler. Air was pumped into the smaller system of

pipes and this pressure acted upon a differential valve in the main riser. The pipe running to the sprinklers connected to the intermediate space of the differential valve, the valve being in the form of two pistons with a travel of several inches.



GRAY DRY SYSTEM 2.

D, sprinkler. *d*, fusible plug in small piping. *B*, angle valve. *M*, *m*, levers holding valve closed. *i*, diaphragm.

2–1886. In 1886 and 1887 the releasing device was modified and instead of a differential valve, an angle valve held closed by a series of levers attached to a diaphragm was used.

Both systems used to a considerable extent. Now practically obsolete.

Device and Material Committee opinion, 1904:

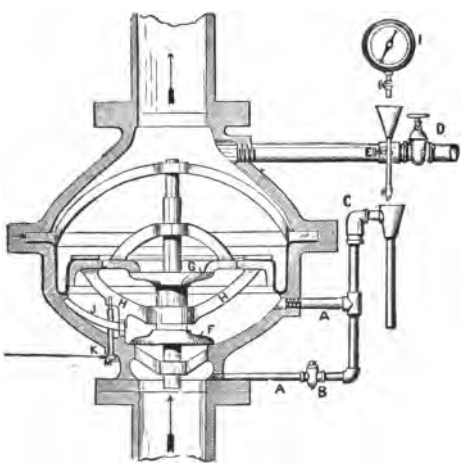
1. Opening action does not give direct relief to water valve.
2. Opening action traversing a pressure retaining joint.
3. Working parts not satisfactorily enclosed.

Present rating: *Unreliable.*

GRINNELL

Manufactured by *Providence Steam & Gas Pipe Co.*

1–Bellows, 1885. This was a differential valve. Water and air clappers held together by a rod which also acted as a guide. Water clapper was metal seating on a horizontal metal seat. Air clapper attached to the casting by rubber bellows giving a total area about eight



GRINNELL "BELLOWS" DRY VALVE.
(Section.)
See description, page 202.

times that of the water valve. The rubber bellows was subject to deterioration and sediment was apt to collect in fold of same. Used successfully for several years. Now practically obsolete.

Present rating: *Unreliable.*

Description. The water clapper *F* is attached to a spindle carrying the air clapper *L* seating on *G*, both seats being metal to metal. There is a large rubber diaphragm clamped to the edge of the air valve and also to the outer casting. This is folded like a bellows to allow considerable movement of the air clapper. The spindle runs in four guides and can be raised until a shoulder comes in contact with a stop, shown near the top of the device. There is a single step latch at *J* to hold the valve up when it opens. *M* is an alarm attachment operating at *K*. There is an automatic drain for the intermediate space, an air test pipe at *E*, and a cup for priming the space above the valve with water.

The differential is due to the difference in area between the water clapper *F* and the air clapper *L*, including the horizontally projected area of the rubber diaphragm.

When the valve opens, the water and the air clappers move upwards until the spindle reaches the stop, the rubber diaphragm being distorted to allow this motion. The water enters the system by flowing around the water clapper *F* and the air seat *G*.

Note: Eleven minor changes were made in this valve between 1885 and 1890 but they were mostly of minor importance. These constitute the eleven types of valve made prior to the so-called No. 12.

GRINNELL

General Fire Extinguisher Co., Providence, R. I.

12–1890. Differential valve. Air and water valve in one flower pot shaped casting. Water seat metal to metal. Air seat consisted of flexible rubber ring clamped to edge of valve. Latch actuated by spring held up the valve when it once opened and prevented columning. Electric alarm connection consisted of metal diaphragm attached to plug which was screwed to casing at intermediate space. This style of electrical circuit closer

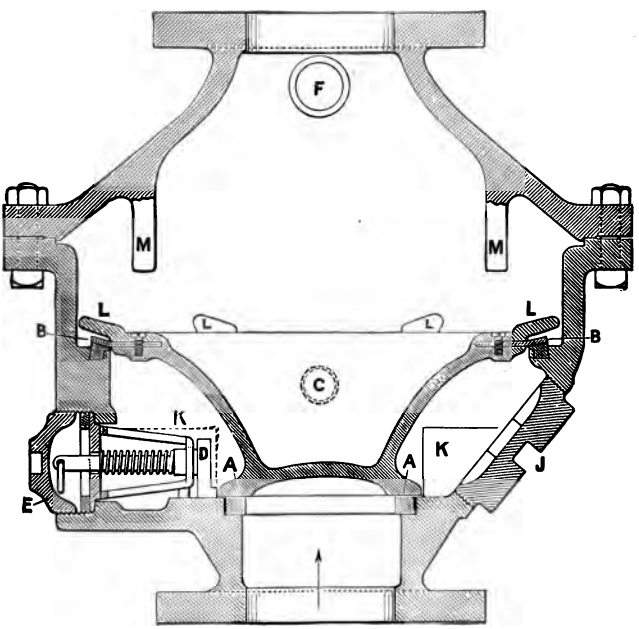
was subject to failure after a few years service owing to corrosion.

Valve criticized by Underwriters' Laboratories as follows:

1. Latch *D* subject to failure.
2. Chance of trouble from scale, etc., on valve seats.
3. Automatic drain defective.
4. Hand hole plugs in intermediate space liable to be left out or to blow out.

Field experience generally very satisfactory.

Rating: *Not standard. Generally satisfactory.*



GRINNELL DRY VALVE NO. 12.
(Section.)

Description. The valve *C* had a water seat at *A* and an air seat at *B*. The water seat was metal to metal but a rubber ring was clamped to the outside edge of

the air seat to give flexibility. The latch *D* operated by a heavy spring held the valve up when it opened and prevented water column. There was a step on this latch part way up and the valve could be latched by this step or by the top of the latch depending upon how much it opened. A hand-hole plug *J* could be removed for cleaning the water seat or examining the intermediate space. The differential was about 7 to 1. There was an automatic drain in the intermediate chamber to take care of any water that might leak past the water valve.

To set the valve the water was shut off and hand-hole plug was removed. After wiping the water seat clean the plug *E* was removed, the latch *D* was pulled out and the valve allowed to drop onto its seats. Priming water was then poured in above the air seat. The air pressure was then pumped in and the water valve opened.

Tests. *Valve should be tested as follows:*

1. For water column by opening test pipe above the valve to see if any water has accumulated. If so it should be drained off.
2. For strength of spring in latch *D*. This is done by unscrewing the small plug covering the latch and pulling on the ring attached to the latch to see that it is in working order. Some trouble has occurred from defective latches.
3. Free way. Open hand-hole plug *J* to see that there is no obstruction in the intermediate space which would prevent the valve from opening.

Note: In 1897 the new circuit closer consisting of a diaphragm operating a knife switch was used.

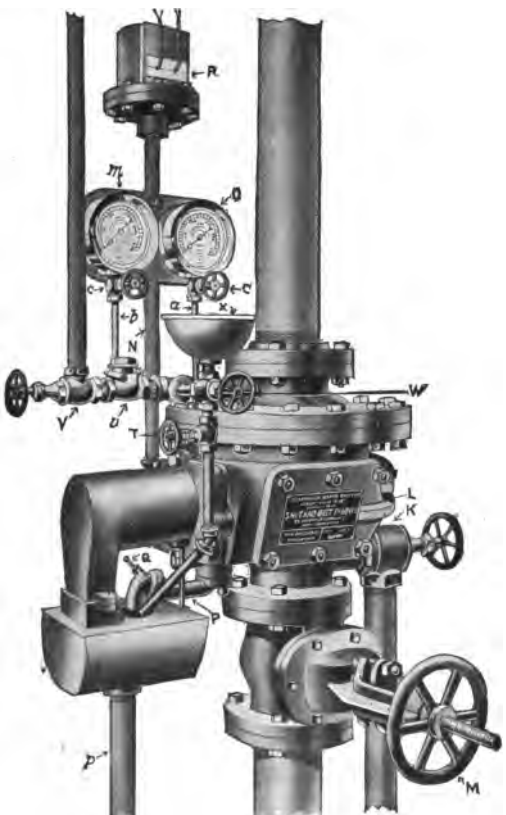
GRINNELL STRAIGHTWAY

General Fire Extinguisher Co., Providence, R. I.

A–1907. Differential type. Lower part of valve is in the form of a gate valve and is attached to a piston working in a horizontal cylinder. When the valve opens this part is pushed to one side by the water pressure,

leaving a free way. Cylinder of bronze. Upper part of body of valve lined with Babbitt metal.

Rating: *Approved.*

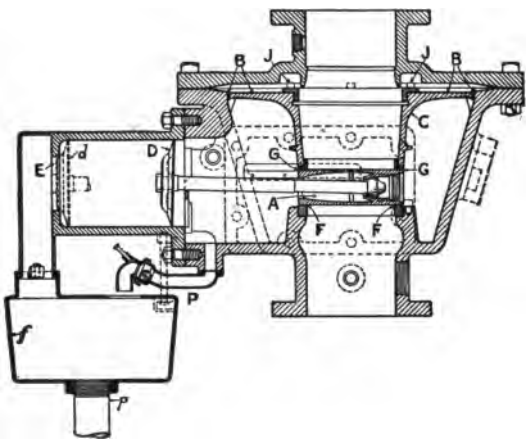


GRINNELL DRY VALVE.
Straightway Type.
General view showing fittings.

B–1910. Same as type *A* except that cylinder and valve body are of iron, copper plated on the inside.

Rating: *Approved.*

Description. The valve J, J, F, F, has a water seat at *F* and an air seat at *G*. The upper part of the valve is attached to a flexible diaphragm *B* clamped between two parts of the valve body. A piston *D* is attached to the movable part of the valve by a rod. This piston fits loosely in a cylinder made of iron, copper plated and



GRINNELL DRY VALVE.
Straightway Type.
(Section.)

tinned. There is a vent *E* at the end. There is a drain pipe *P* connecting with the intermediate space and having an automatic ball drip on the end. When the air pressure on the diaphragm and air valve is sufficiently reduced, the water pressure will force open the valve a small amount. The water entering the intermediate space will fill it and then force the piston *D* to the further end of the cylinder where it closes the vent *E*. This carries with it the valve disc, leaving a free water way through the system.

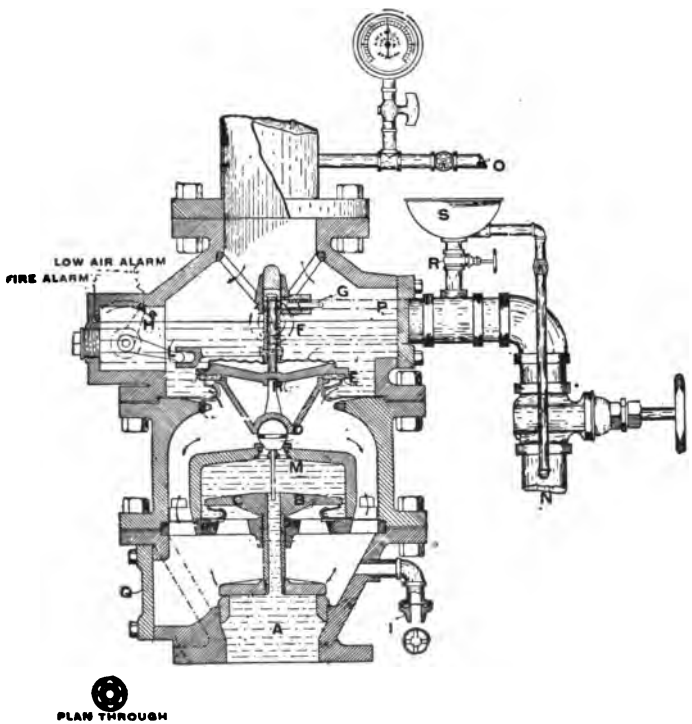
Tests.

1. Open draw-off pipe to test for water column.

2. Open hand-hole plate to intermediate space occasionally to see that there are no obstructions and that water valve is tight.

HIBBARD

1–1894. Made by *American Fire Extinguisher Co., Chicago.*



HIBBARD DRY VALVE 1.

(Section.)

A, B, C, water valve. M, small water valve held in place by air valve E. N, draw off pipe. S, priming cup.

Differential type. The air check seated on a flexible spun brass seat and held a small water valve on its seat. When the air pressure was released, the water flowing through the small valve relieved the pressure on the upper side of a double-seated water valve. This latter valve was then raised by the water pressure in the system opening the main water way.

Only about 100 made. Manufacture discontinued in 1900.

Opinion of Device and Material Committee, 1904:

1. Susceptible to internal corrosion.
2. Dependent upon delicate adjustment.
3. Liable to permit excessive air leakage.
4. Cannot be set without risk of water damage.

Present rating: *Unreliable.*

2–1898. Made by *National Fire Extinguisher Co., Kansas City, Mo.*

Differential counterweighted.

Opinion of Device and Material Committee, 1904:

1. Difficult to set without producing water column.
2. Subject to disablement from back slap.
3. Adjustment easily destroyed by minor repairs.

Manufacture discontinued in 1901. Very few in service.

Rating: *Unreliable.*

3–1898. Made by *Mallers, Allen, Fraser & Co., Chicago, Ill.*

"Pile driver" type. This consisted of two swing checks seating horizontally in the main water-way with an intermediate space between. The lower or water check was held closed by a lever extending through a hole in the casing to the outside and pivoted to a vertical rod. There was a large weight enclosed in a cylindrical casing and sliding on this rod. When the valve was set, this weight was held up by a lever connected to a small auxiliary air valve. When the air pressure

was released the weight fell and striking the end of the water valve lever opened this valve.

Over 100 made. Manufacture discontinued in 1900.

Opinion of Device and Material Committee, 1904:

1. Liable to be inoperative under service conditions.
2. Opening action fails to give direct relief to water valve.

Rating: *Unreliable.*

4–1909. *Geo. E. Hibbard, Chicago.*

Differential type. Plans submitted in December, 1909, and criticized by Underwriters' Laboratories. Revised plans submitted, 1911. No finished valve submitted. Never used so far as known.

HIGGINS

Kellogg-Mackay-Cameron Co., Chicago.

Opinion of Device and Material Committee, 1904:

1. Liable to be inoperative under service conditions.
2. Opening action not positive under high-service pressure.
3. Opening action fails to give direct relief to water valve.
4. Opening action traverses a pressure-retaining joint.

But few made. Manufacture discontinued in 1901.

Rating: *Unreliable.*

IDEAL

Ideal Automatic Fire Extinguisher Co., Philadelphia.

"Ever ready" dry-pipe valve. Plans examined and criticized January, 1912, and March, 1913, by Underwriters' Laboratories. No working device submitted to date.

IDEAL

Patented by *John H. Derby, Boston, Mass.*

1–1899. Mechanical valve. Water clapper held closed by toggle-joint levers bearing against a spindle and

attached to air clapper. Air clapper of larger area than water clapper and of inverted type.

2–1903. Differential valve. Bronze double-seated valve placed in an inverted position, the lower or larger area being held up by air pressure. A swing check valve kept the air out of the intermediate space.

Report by Underwriters' Laboratories, January, 1906. Features criticized:

1. High trip point.
2. Arrangement for outside connections.
3. Difficulty of repairs.
4. Weakness of parts.
5. Features of design and construction.

3–1906. Mechanical valve with two horizontally seating swing checks. Upper or air check held the lower check closed by means of a lever and a strut.

None of the types were ever put on the market.

INDEPENDENT

Independent Fire Sprinkler Co., Chicago, Ill.

1902. Mechanical valve. Vertical check valve held in place by wedge. A small auxiliary air valve held a train of levers outside the valve casing in position. These levers were released when the air pressure dropped, thus releasing a heavy weight. This gave a threaded spindle a quarter turn thus pulling out the wedge so that the water valve could open.

Underwriters' Laboratories Report, March, 1902. Features criticized:

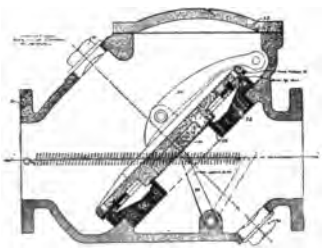
1. Effects of water column.
2. Opening movement.
3. External operating parts.
4. Internal sliding parts and complication of parts.

Rating: *Unreliable.*

INTERNATIONAL

International Sprinkler Co., Philadelphia, Pa. Patented by J. C. Scott, August, 1900.

1900. Differential. This was a swing check valve seating at an angle of about 45 degrees. There was a large groove or intermediate space in the valve seat giving a differential of 4 to 1. An O. S. & Y. gate valve was so placed that the stem would hold the check closed when screwed down. This was used in setting the valve. This was omitted in later type. A latch operated by an external spring was used to hold the valve open when it tripped.



INTERNATIONAL DIFFERENTIAL DRY VALVE.
(Section.)

Opinion of Device and Material Committee, 1904:

1. Subject to injury from back-slap.
2. Has opening action involving traverse of a pressure retaining joint.
3. Unduly subject to water hammer.

But few made. Manufacture discontinued in 1901.
Present rating: *Unreliable.*

1902. Mechanical. Angle valve.

Vertically seating water valve held in place by a system of levers and weights, the last lever bearing upon a depression in the lower side of air clapper. Air valve a swing check seating horizontally. When the air pressure is released the leverage forces the air clapper up, thus tripping the system of levers and allowing the pressure in the supply pipe to open the water check.

There are four models of this valve varying but little except that in the first model the plate to the intermediate space could be removed without tripping the valve. This allowed the examination of the valve seats for leakage but was undesirable as the system could be set up with the plate off and it would be possible to forget to replace the plate.

Many of these valves have been installed.

Field experience satisfactory.

Rating: *Standard.*

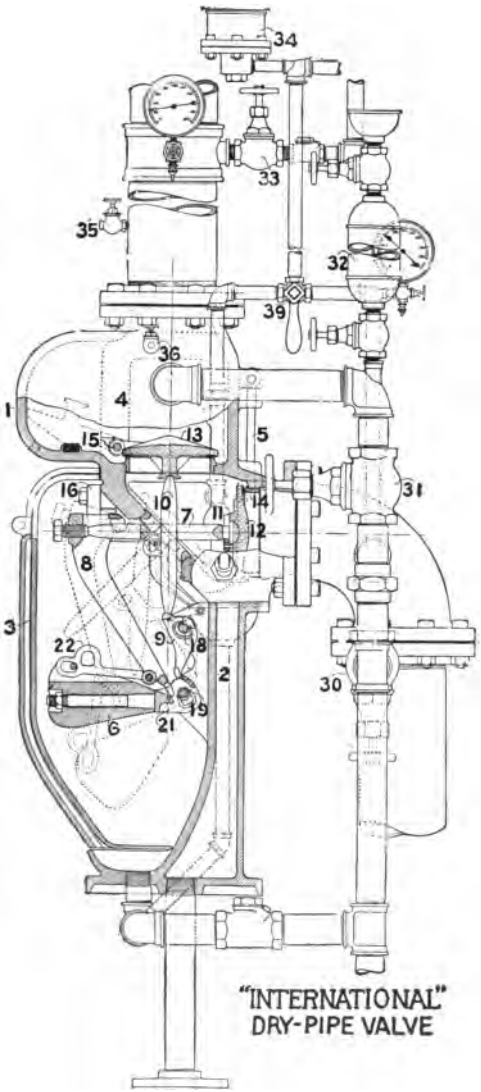
Description. The water supply enters horizontally and is held back by a vertically seating valve 12. A swing check 13 seating horizontally holds the air pressure back from the intermediate space. This is primed with water to the level of the draw-off pipe. The water valve is held in place by the horizontal lever 7 adjusted by the set screw. The horizontal lever is connected with the curved lever 8 and this holds up a pivoted weight 6. This weight is held up by a vertical lever 10 bearing directly on the under side of the air clapper 13 and at the lower end on a short lever 9. Both clappers are metal to metal.

When the air pressure is released the vertical lever 10 is pushed up, thus releasing the weight and the whole train of levers that holds the water valve in place. When the water valve opens it swings through an angle of 45 degrees seating tightly on the opening through which the levers pass.

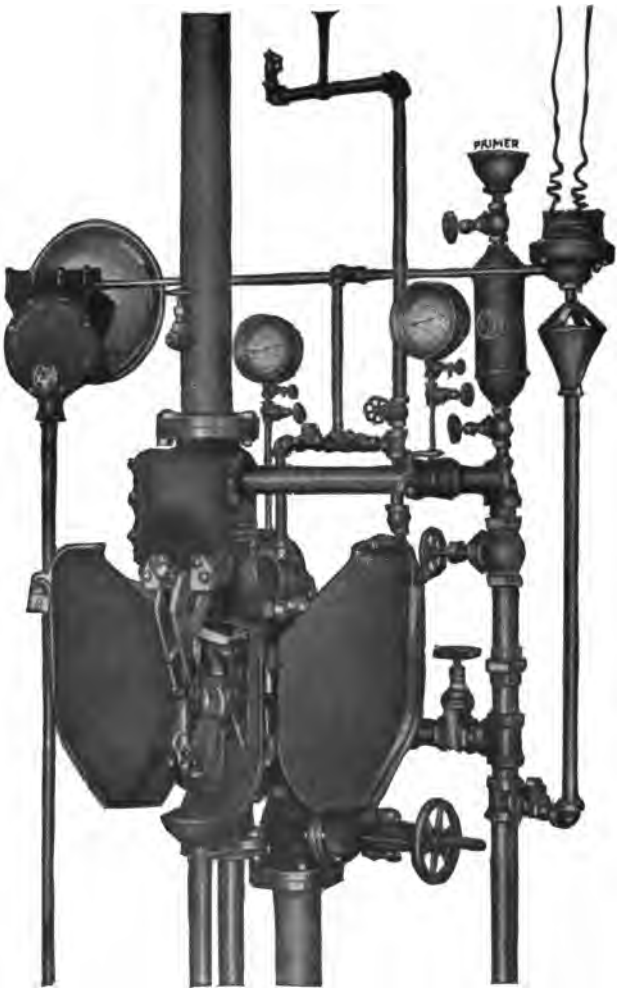
The alarm attachments are similar to those used in the International alarm valve and connect with the intermediate space.

Tests and Examinations. Valve should be tested for water column by opening the test valve above the air check.

The casing around the levers can be opened to see that the parts are properly set up and not obstructed.



INTERNATIONAL DRY-PIPE VALVE.
(Section.)



"INTERNATIONAL" DRY-PIPE VALVE
(Doors open showing valve set up.)

KANE

John Kane, Philadelphia, Pa.

1889. A globe valve with a sliding spindle controlled by a pivoted lever having a fixed weight at one end and a heavier weight resting on the opposite end to hold the valve normally closed. A lighter weighted and pivoted lever actuated by a diaphragm, subjected to the system pressure, was attached to a releasing mechanism pivoted to the end of the main lever in such a way that when the pressure was reduced the weighted end of the auxiliary lever dropped, raising the opposite end and dislodging the heavy weight from the end of the main lever. Not used to any extent.

Underwriters' Laboratories Report, 1904. Twelve features criticized.

Rating: *Unreliable.*

KERSTETER

Made by *C. W. Kersteter.*

1–1895. Differential. Horizontal valve. This consisted of a differential valve with air and water seat in one plane. This was located in a casting above the main water way. The intermediate space was in the form of a groove. A spindle extended from this valve to a globe valve located in the main water way. An air pipe extended from the system above the dry valve to the space over the differential valve. When air pressure was released the differential valve was forced up carrying with it the globe valve and opening the water way.

Device and Material Committee opinion, 1904:

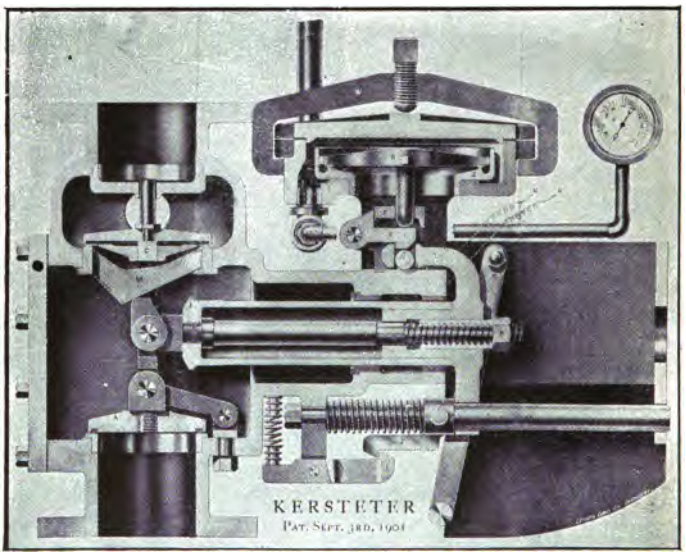
1. Not substantial in construction.
2. Not designed to withstand heavy pressure.
3. Subject to intermittent action after opening.
4. Invites process of setting which may leave it water columned or gagged.

Rating: *Unreliable.*

KERSTETER

Made by *National Fire Extinguisher Co., Kansas City.*

2–1901. **Mechanical Valve.** Vertical air check and swing water check valve in main water way. Water valve held closed by levers, operated by an auxiliary air valve. When the air pressure was released, the air valve was pushed up, thus releasing a rather complicated mechanism and pulling out a lever which wedged the water valve in place.



KERSTETER DRY VALVE 2.
(Section.)

Report of Underwriters' Laboratories, 1903, criticized the valve as follows:

1. Too much variation in adjustment.
2. Opening action not positive.
3. Subject to false tripping and misadjustment as a result of wear.

4. Invites process of assembling that may leave it gagged.
5. Not designed to withstand heavy pressure.
6. Subject to clogging by mud, etc.

Rating: *Unreliable.*

LINN

Made by *A. D. Linn, Grand Rapids, Michigan.*

1894. **Differential.** This consisted of a vertically rising air check and water check with an intermediate space between. The air seat was offset so that it did not come directly above the water valve. The air check was connected to a hinged lever extending outside the casing with a weight on the end. A system of interior hinged levers connected the air and water valves so as to give the desired differential.

Manufacture discontinued in 1897.

Opinion of Device and Material Committee, 1904:

1. Not suited to all service conditions.
2. Unduly complicated.
3. Dependent on delicate adjustments.
4. Comparatively unsuccessful when corroded.

Rating: *Unreliable.*

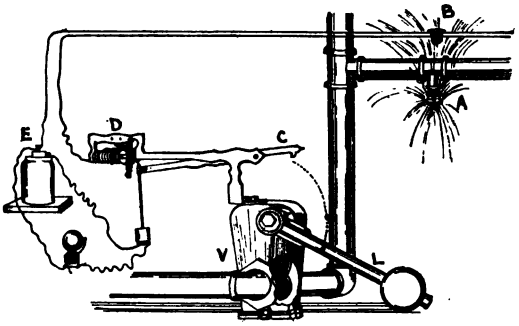
MACKEY

John C. Mackey, Syracuse, N. Y.

Gate valve, normally closed and opened in case of fire by means of an auxiliary thermostat system. There was a heavy weighted arm connected to the gate valve. This was held up by a tripping lever *C*. When a thermostat operated, the electro-magnet *D* was energized and this pulled the tripping lever and allowed the arm to fall, thus opening the valve.

Now obsolete.

Rating: *Unreliable.*



MACKEY DRY SYSTEM.
A, sprinkler. B, thermostat. C, tripping lever. D, magnet. L, lever. V, valve.

MANUFACTURERS

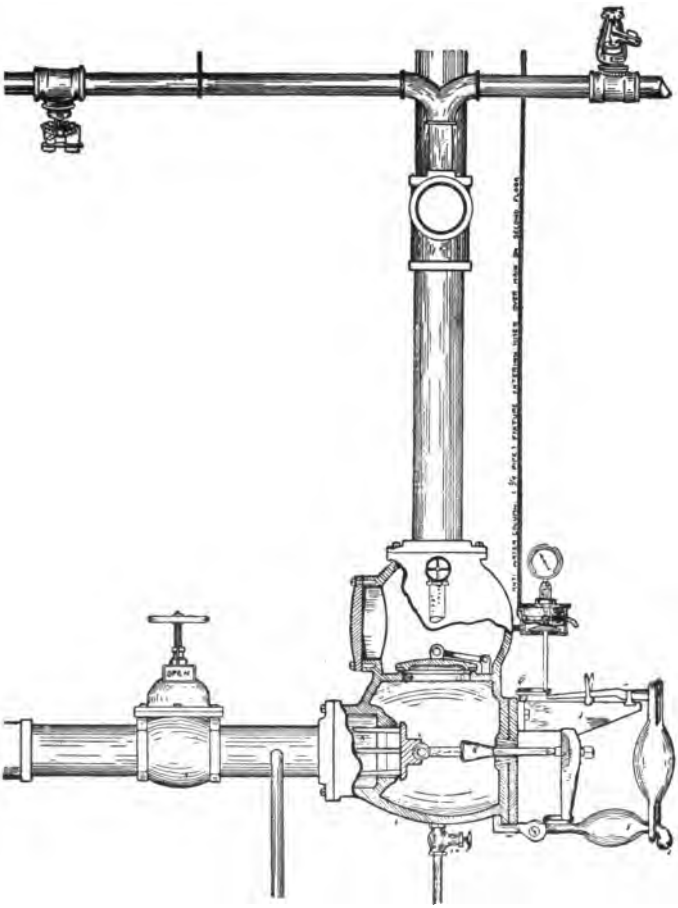
Manufacturers Automatic Sprinkler Co., Syracuse, N. Y.
Later "*Automatic*" *Sprinkler Co. of America.*

1–1892. **Robert Wood Type.** Mechanical valve, angle type. Swing air check, seating horizontally. Sliding water valve seating vertically. Water valve held in place by system of external levers and weights. An auxiliary air valve connecting with sprinkler system on story above, to prevent water columning, held levers in place. The auxiliary air valve was metal to metal and difficult to keep tight.

Criticized by Underwriters' Laboratories, 1907, as follows:

1. Invites process of setting that will leave valve gagged or water columned.
2. Permits degree of variation in adjustment, causing excessive variation in trip point.
3. Is dependent on loose parts.
4. Features of design and construction.

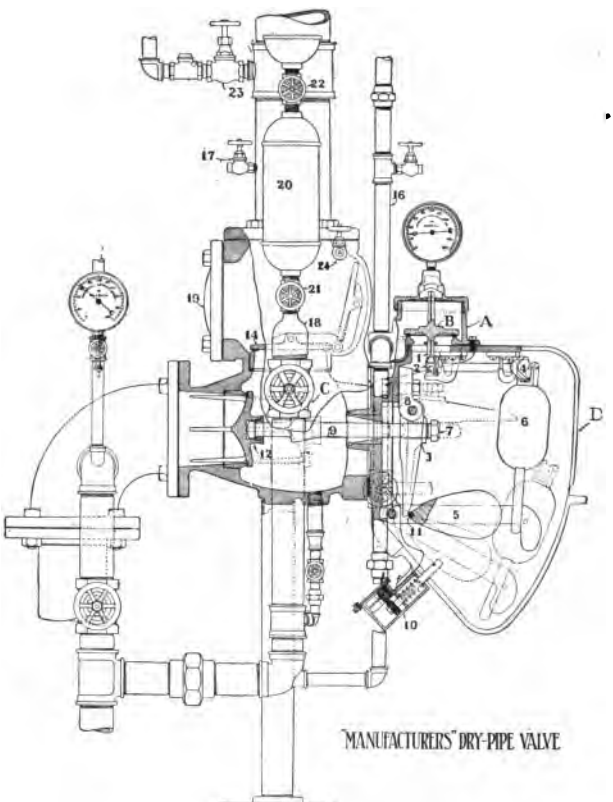
Field experience unsatisfactory after a number of years service due to leaking of auxiliary air check and



MANUFACTURERS DRY VALVE.
Robert Wood Type.
(Section.)

general use of gaskets, etc., to make it tight. A large number of valves failed on test from this cause.

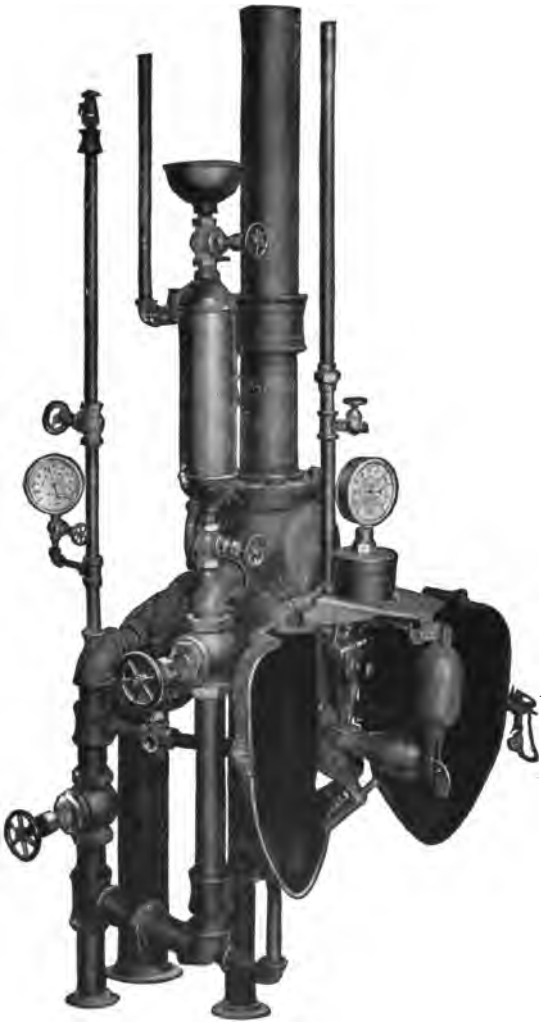
Present rating: *Unreliable with old air pot.*



MANUFACTURERS DRY-PIPE VALVE 3.
(Section.)

3–1907. New air pot of larger diameter. Weights and levers enclosed by swinging metal doors. Approved.

Rating: *Standard.*



MANUFACTURERS DRY VALVE.
No. 3 Model. General View.

Description. The water valve 12 seats vertically and is held closed by horizontal stem adjusted by set screw 7.

This stem has a conical shaped enlargement 9 which, when the valve opens, tightly closes the orifice through which it passes. A train of levers and weights, 3, 5, 6, 4, 2, resting finally on the under side of an auxiliary air valve *B*, holds the valve closed. The main air check is at 14 and this keeps the air pressure out of the intermediate space. An air pipe 16, connecting with the sprinkler system on the 2nd floor, holds the auxiliary valve down. When the air pressure is reduced the train of levers is released and the valve is opened by the water pressure. The rotary gong is connected to the intermediate space. The electric circuit closer is at 10 and is operated by the weight 5 striking a small plunger.

Tests and Examinations. 1. Open the air cock above auxiliary air check to see that there is no accumulation of water that might column the valve. 2. Open casing around levers to see that they are properly set up and not obstructed. 3. In the old type care should be taken to see that the auxiliary air check has not been set up with a gasket or other foreign material and that the unenclosed levers are not obstructed.

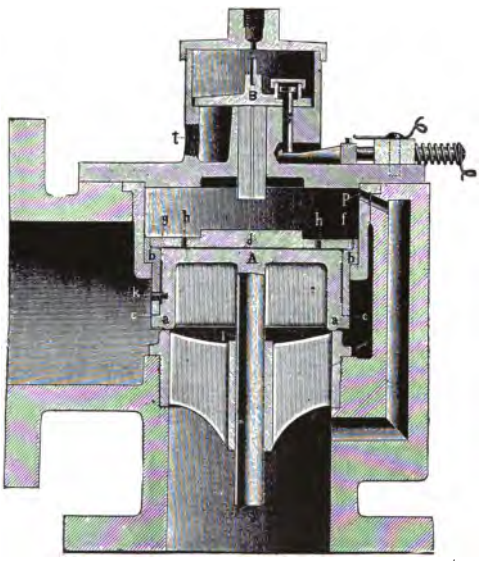
NAGLE

F. Nagle. Nagle Automatic Sprinkler Co., Chicago.

About 1889. This was a differential valve with a ratio of 1 to 15.

Description. The waste valve *B* is double seated, the intermediate space being connected to the atmosphere. The small outlet above this valve is connected to the sprinkler pipes normally under air pressure, thus allowing the air pressure in the system to rest on top of this valve. Water pressure from the main supply pipe reaches the lower side of the valve *B* through the by-pass *P*.

The main valve *H* is also a differential valve seating at *a* and *b*. The upper area is 60 per cent larger than the lower area. The by-pass *P* allows water to rest above as well as below the valve, thus holding it closed on account of the differential.



NAGLE DRY-PIPE VALVE.

(Section.)

When the air pressure in the system is sufficiently reduced the waste valve *B* will open. The by-pass *P* being smaller than the waste pipe *t*, the water pressure above the main valve is soon reduced and this valve opens.

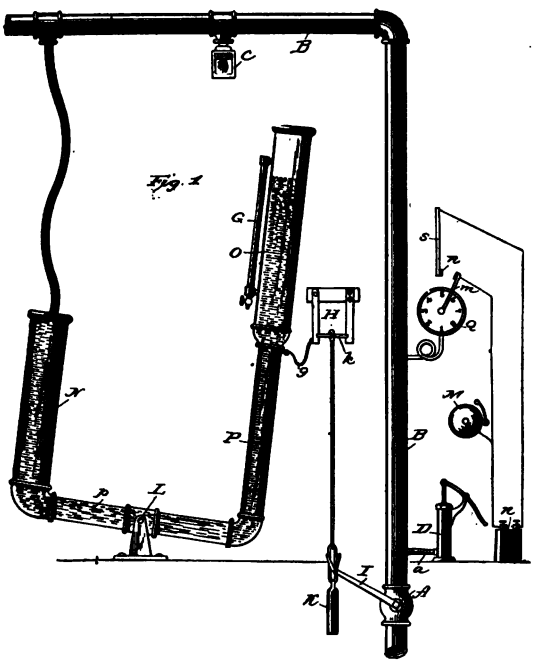
There is a pin and latch connected to the waste valve *B* which operates an electric bell when the valve opens.

Present rating: *Unreliable.*

NERACHER

Wm. Neracher, Cleveland, Ohio.

1–1887. Lever type. There was a cock in the main pipe operated by a lever moving through an angle of



NERACHER DRY VALVE 1.

A, cock valve in main riser *B*. *N*, *P*, U-shaped tube. *L*, pivot. *D*, air pump. *K*, weight. *g*, cord. *k*, pin pulled out when U-tube rocked back, thus releasing weight.

90 degrees. When the system was set up the cock was closed and the lever engaged with a cord and weight connected with a large U-shaped tube. This tube had a short closed end and a longer open end and was pivoted at the center so that it could rock back and forth. It

was filled with water up to the level of the top of the short arm. Air was pumped into the system above the cock and a flexible tube connecting the U-tube to the sprinkler system allowed the air pressure in the pipes to enter the short end of the U. This forced the water up into the long arm and caused the tube to rock in that direction. When the air pressure was released, the water level in the long arm dropped and this caused the U-tube to rock back to its normal position. This motion was transmitted to the lever by means of the cord and forcibly opened the cock.

In a later type a diaphragm was used instead of a rocking U-tube.

NERACHER

Neracher Sprinkler Co., Warren, Ohio.

2–Piston Type. Device and Material Committee opinion, 1904:

1. Has opening action traversing a pressure retaining joint.
2. Liable to intermittent action after tripping.

But few made.

NYASCO

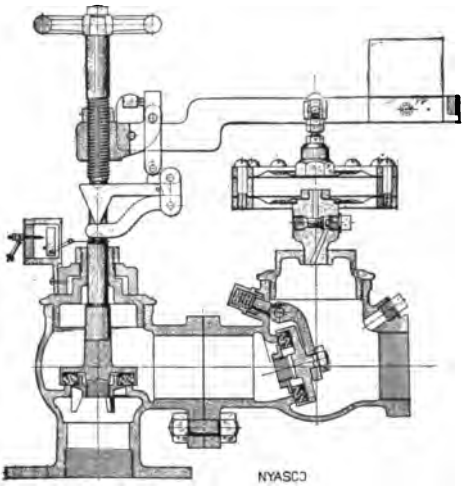
New York Automatic Sprinkler Company, New York.

1913. This is a mechanical valve built at present only in small sizes. Made primarily for steam jets in vessels.

A horizontally seating check valve is held in place by a spindle and system of levers. A corrugated metal diaphragm is attached to the air side of the check valve and the pressure on the diaphragm holds the tripping levers in place. When the air pressure is released the diaphragm falls and releases the levers.

Not yet used to any extent.

Recent tests developed mechanical difficulties which show the valve to be unreliable.



NYASCO DRY VALVE.
(Section.)

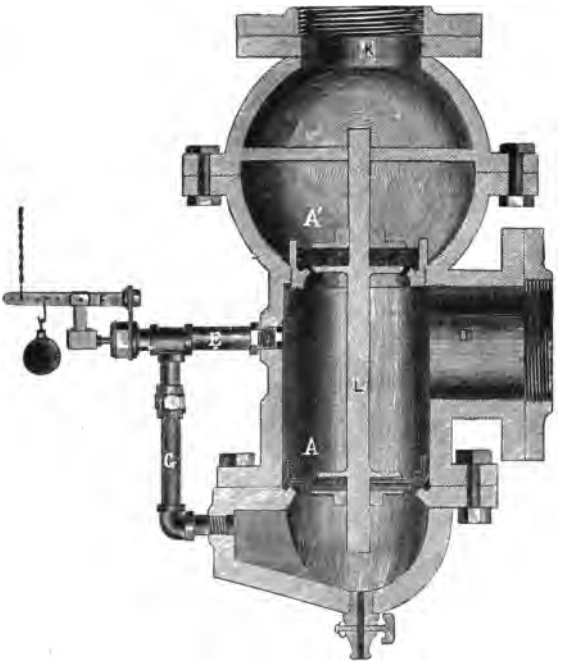
N. Y. & N. H.

Installed by the *New York and New Haven Automatic Sprinkler Co.* Office, New York. Factory, New Haven.

About 1889. This was a differential valve operated by an auxiliary thermostat system. In the cut the inlet is shown at *D* and the outlet at *K*. The inlet pipe was connected to the device between the two parts of the differential valve *A*–*A'*. The valve disc *A* moved in a cylinder and was of larger area than the valve disc *A'* which seated on a knife edge. The water pressure acting on both discs held the valve closed on account of the differential.

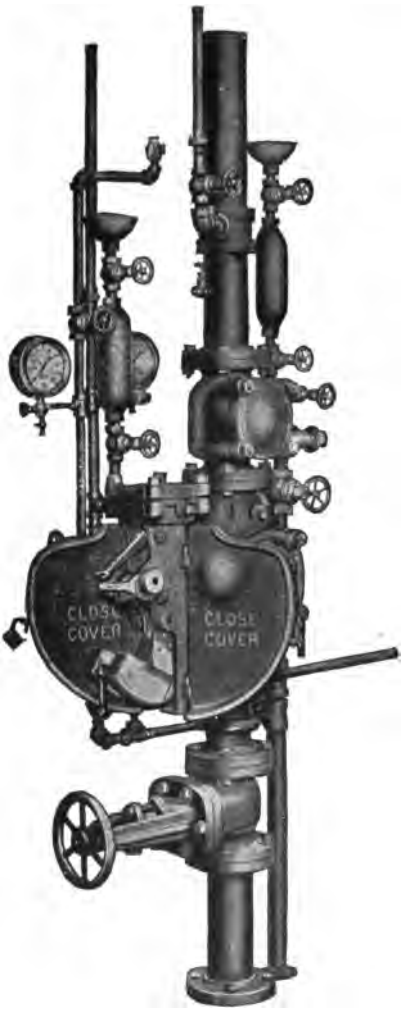
The lever *F* was released by the thermostat system which was installed parallel to the sprinkler pipes. This opened a valve in the by-pass *E*, *G*, and allowed water to pass into the chamber, normally free from pressure, below the valve.

This created a pressure on the lower side of the lower valve disc which balanced the pressure on the upper side of this disc. The pressure on the under side of the upper valve disc then raised the valve and allowed water



N. Y. & N. H. Dry Valve.
(Section.)

to flow into the system. This valve was also installed with a vacuum system. In this a system of small lead piping was installed near the sprinkler piping. A hole was bored in this piping near each sprinkler head and filled with low-fusing solder. This piping terminated in a vacuum diaphragm which operated the lever *F*. Air was exhausted from the small piping, thus raising the



NIAGARA DRY VALVE.
(General view, tripped.)

diaphragm. When fire occurred a fusible plug melted, thus letting air into the vacuum pipes. This operated the diaphragm and tripped the lever, thus opening the dry valve.

There was an alarm gong connected to each system.

Used to a limited extent.

Present rating: *Unreliable.*

NIAGARA

Niagara Fire Extinguisher Co., Akron, Ohio.

1–1902. Mechanical valve. Water valve a swinging check held in place by a system of levers and weights. A swing check air valve was located higher up leaving an intermediate space. Levers tripped by an auxiliary air check.

Features criticized by Underwriters' Laboratories:

1. Setting process.
2. Adjustment.
3. Action in opening.
4. Effect of muddy water.
5. Design and proportions.

Field experience shows uncertainty of action.

Rating: *Unreliable.*

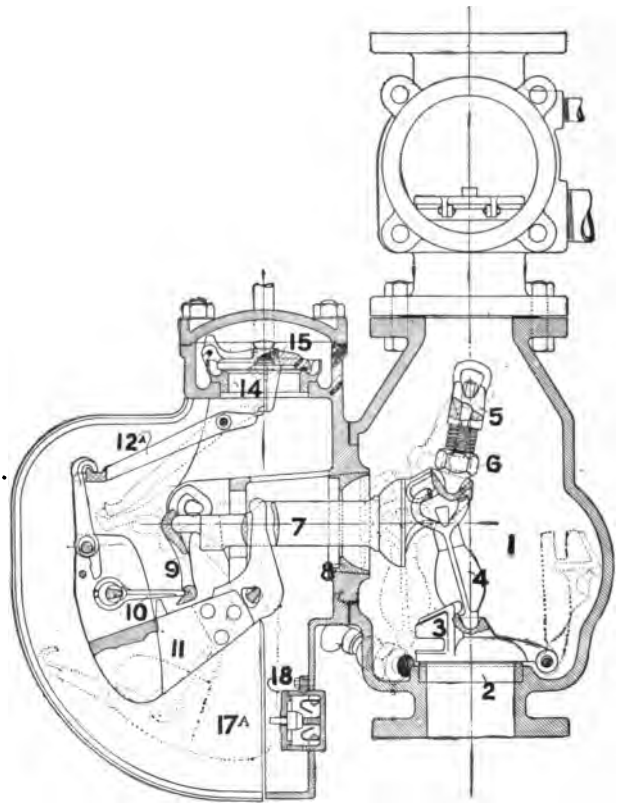
2–1909. Modification of above. Approved.

Rating: *Standard.*

Description. There is an air pot with an air check that holds in place a train of levers and weights which, when they are released, allow a horizontal plunger bearing against the toggle strut to be thrown out.

The operation of the valve is as follows: When the air pressure in the system is released by the fusing of a sprinkler, the air check 15 is pushed up and this acts on the trip lever 12–*A* which releases the weight hook and the weight 11. The horizontal strut 10 then releases the fulcrum lever 9 which holds in place the

plunger 7. When this plunger is released the toggle strut 4–5 collapses and the water check 2, no longer held in place, is opened by the water pressure. The



"NIAGARA" DRY-PIPE VALVE

(Section.)

water then flows up through the valve body and air check into the sprinkler system. The intermediate space is drained by an automatic ball drip and the elec-

tric alarm is given by a circuit closer 18, operated by the falling weight 11.

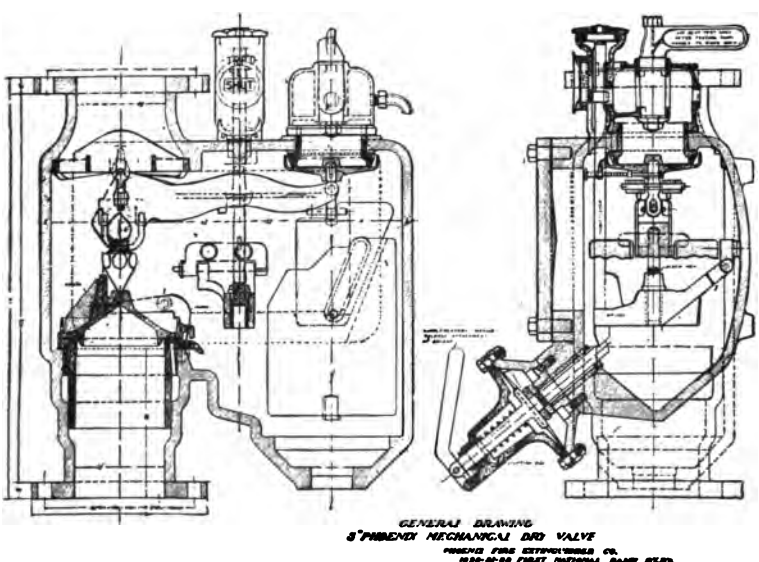
Tests and Examinations. Open drip valve above air check.

Open casing and examine levers.

PHŒNIX

Made by *Phœnix Fire Extinguisher Co., Chicago, Ill.*

1. **Differential.** Horizontally seating water valve. Connected by a curved arm to a vertically seating air



PHŒNIX DRY VALVE.
(Sections.)

valve of larger area. This large valve could swing through an angle of 90 degrees in an offset to the main pipe. An auxiliary air pipe connected this offset to the

sprinkler piping, thus putting the air pressure onto this valve. When the air pressure was released the large valve would swing open carrying the water valve with it. There was also another air check in the main pipe above the water valve.

Underwriters' Laboratories Report, 1906, criticizes:

1. Working differential.
2. Bolted plate opening to intermediate chamber.
3. Seats liable to damage from sediment.
4. Automatic drain.

Not used so far as known.

2–1904. Mechanical valve.

5-inch size approved by Underwriters' Laboratories, 1908. Approval withdrawn, 1909. Manufacture discontinued.

Present rating: *Satisfactory.*

RICHMOND

McCrum Howell Co., Chicago.

Plans submitted to Underwriters' Laboratories. No complete device submitted to date.

ROCKWOOD

Geo. I. Rockwood, Worcester, Mass. Made by *Worcester Fire Extinguisher Co.* Later *Rockwood Sprinkler Co.*

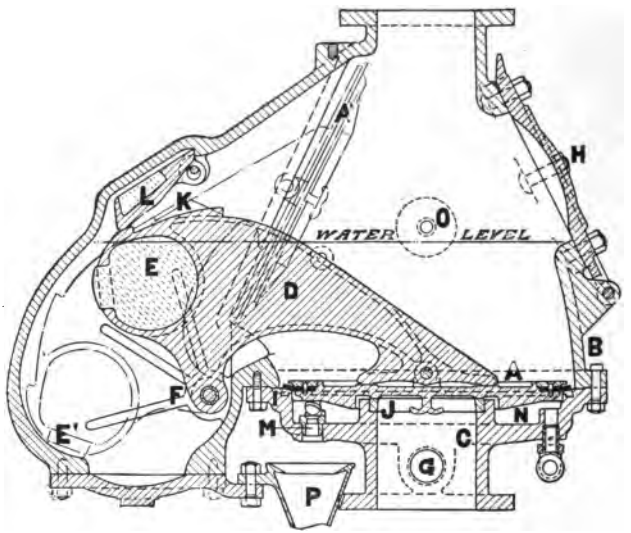
1–1906. Copy of Grinnell differential No. 12. Approved until 1907.

A–1908. Differential valve. Large counterweighted swing check valve with air and water seat. Groove or intermediate space between air and water seat contains an automatic drip. A few of the earlier valves had a spring latch working vertically. This was replaced with a gravity hinged latch in 1909.

Rating: *Standard.*

ROCKWOOD DRY VALVE A.
(General view.)

Description. The differential valve *A* has a metal water seat and a rubber to metal air seat in the same plane. There is a groove *N* between these seats which acts as an intermediate space. There is an automatic drip *M* connected with this space as well as the alarm attachments. The valve is connected to a large arm *D*



ROCKWOOD DRY VALVE A.
(Section.)

pivoted at *F* and counterweighted at *E*. There is a hinged latch *L* to prevent it from closing after it has once opened. The interior of the chamber is readily accessible through a large hinged hand-hole plate *H*.

Tests and Examinations. Test for water above draw-off pipe. Test automatic drip *M* to see that it is free and not obstructed by dirt.

SHAW

Campbell B. Shaw, St. Louis, Mo.

1–1898. Mechanical valve. Water valve held closed by spindle extending through stuffing box and connected to a system of levers. These levers were tripped by the opening of a small auxiliary air valve in somewhat the same way as in the Robert Wood valve.

Rating: *Unreliable.*

2–1903. Assigned to Shaw Manufacturing Co. Mechanical valve. Water valve held closed by levers extending to outside of casing and tripped by auxiliary air valve.

Underwriters' Laboratories Report, 1902, criticizes:

1. Setting process.
2. Opening movement.
3. External operating parts.
4. Complication of part.

Rating: *Unreliable.*

STECK

E. F. Steck, Chicago. Assigned to *Fire Extinguisher Manufacturing Co.*

1–1898. Mechanical valve. Water check opening against pressure was opened by a lever counterweighted with a bucket. When the air pressure was released a small air valve was opened and this allowed some entrapped water to flow into the bucket. The weight of this water opened the main valve. Not used so far as known.

Rating: *Unreliable.*

2–1898. Similar to above except that valve was opened by a system of weighted levers held in place by small air valve.

Rating: *Unreliable.*

U. T. D. OR COX

Made by *U. T. D. Sprinkler & Supply Co., Chicago.*

Manufacture discontinued in 1900.

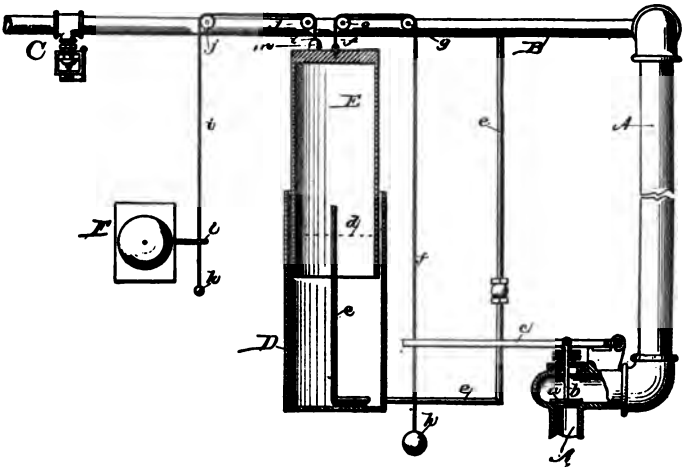
Opinion of Device and Material Committee, 1904:

1. Liable to be inoperative under service conditions.
2. Difficulty of cleaning and setting.
3. Dependent on skilled adjustment.
4. Subject to tripping from cessation of water pressure.

Rating: *Unreliable.*

WALWORTH

Made by *Walworth Manufacturing Co., Boston.*



WALWORTH DRY VALVE 1.

(Section.)

A, supply pipe. *a*, *b*, angle valve. *e*, lever. *f*, cord. *h*, weight. *D*, outer tank. *E*, inner tank. *e*, air pipe from sprinkler system.

1–1884. This dry valve was one of the earliest on the market and was patented by C. C. Walworth and O. B. Hall of Boston in 1884. It was installed by the Walworth Manufacturing Co. for a number of years

but is now obsolete. It was not a differential valve and still did not bear much resemblance to the ordinary type of mechanical valve. The actuating device was a tank of water with an inverted tank or bell float inside on the principle of a gasometer. A cord was attached to the bell float and extended through a hole in the outer tank over a pulley to a weight. Air was pumped into the bell float, thus raising it to the stops. A pipe from the sprinkler system connected to the pipe feeding the bell float, thus putting the same air pressure onto both the sprinkler system and the tank. The cord from the bell float engaged with the end of a long lever attached to a normally closed angle valve in the main sprinkler pipe.

When the system was set up the main valve was closed and held closed by the weighted lever. The air pressure in the system raised the bell float, thereby allowing the weighted cord to fall to its lowest position. When a sprinkler opened the air pressure was exhausted and the bell float dropped. This raised the weighted cord which, pulling on the lever, opened the valve and allowed water to enter the system.

2–1884. In another variation of this device a spindle valve was used instead of a lever valve, the cord from the bell float being wound around a drum on the valve spindle. When the bell float dropped the cord turned the spindle and opened the valve.

Both used to some extent. Obsolete.

Present rating: *Unreliable.*

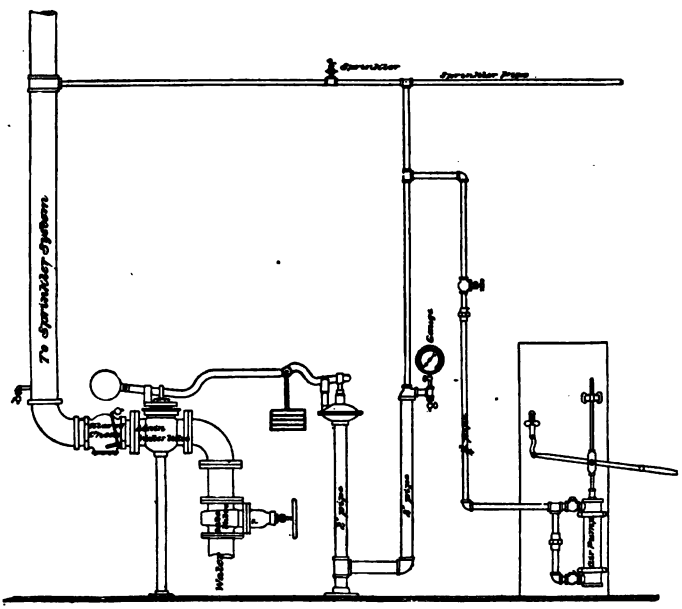
WALWORTH

3–1885. In a later type a globe valve was used to hold the water back. The stem of this valve extended through a stuffing box and was loosely fastened to a weighted lever. The long end of this lever was held

in place by a tripping device operated by a diaphragm. When the lever was released by the reduction of air pressure the weighted end of the lever dropped and opened the valve. A check valve with a weighted stem kept the air pressure from the upper side of the globe valve.

Used to a limited extent. Obsolete.

Present rating: *Unreliable.*



WALWORTH DRY VALVE 3.

COMBINED SPRINKLER AND HEATING SYSTEMS

It is a curious fact that in the first automatic sprinkler system ever installed an effort was made to combine a heating system with the sprinkler system and that no serious attempt was made to repeat this experiment until very recently. The system in the Parmelee Piano

Factory in New Haven, installed in 1874, was used for heating in extremely cold weather. There was an auxiliary system of steam pipes of sufficient capacity to heat the building in moderate weather, but in very cold weather steam was let into the sprinkler pipes. The sprinkler heads were placed upon inverted U pipes to form a trap which would remain full of water and thus keep the steam from heating the heads unduly. The Parmelee system of piping, being a " tree " system, was especially adapted for this purpose, for the heat that circulated in the main feed pipes would not cause much circulation in the branch pipes in which the sprinklers were located.

There were three feed lines running lengthwise of the building with cross feeders at the ends and in the centre. At the end of each cross feed was a pipe with a valve extending out of doors. These were used to bleed the system and start a circulation when the steam was let in. The system was not entirely satisfactory and the steam connection was finally abandoned.

Another attempt has recently been made to use automatic sprinkler pipes for heating purposes, and incidentally to prevent the sprinkler system from freezing, by circulating hot water through the pipes.

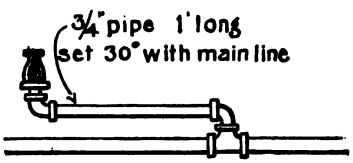
Such a system was installed in the weave shed of a large cotton mill in New Bedford about three years ago and others have since been completed.

The New Bedford building is of large area (300 by 237 feet) basement and one story in height. The sprinkler system is fed by an eight-inch pipe from the yard mains supplied by city water and a steam pump. There is a check valve on the eight-inch pipe just inside of the building.

In the basement the entire sprinkler system is used as a heating system and there is no other heat. There are check valves in the larger branch pipes close to the

main feed pipe to prevent circulation in the latter. The ends of all branch lines are tied together and connected to two four-inch headers or supply pipes from the hot water heater. This heater is located in the basement of the engine room adjoining, and the four-inch pipes are run from the sprinkler system into the heater, making a complete circuit. The hot water, starting in one four-inch pipe, circulates through all the smaller sprinkler pipes and returns through the other four-inch pipe.

The weave shed above has a sawtooth roof, with sprinkler branch lines running to dead ends at the top of each sawtooth. Here no attempt is made to use the smaller sprinkler pipes for heating purposes, but the heat is obtained by circulating the water through the larger sprinkler pipes and some auxiliary heating coils.



SPRINKLER OFFSET.

Combined sprinkler and heating system.

Perhaps the most interesting feature of this system is the method used for preventing the operation of the sprinkler heads from the heat of the water. The heads are of the Grinnell glass disc type, and are practically all low test, melting at about 160° F. The hot water has an average temperature of 180° to 200° F., the maximum temperature used being about 245° F. In order to prevent overheating the sprinklers, they are placed on short offsets in which the water does not circulate. The offsets in this case are of $\frac{1}{2}$-inch pipe and are about one foot long. They are placed about three inches above the main pipe and connected to it by a $\frac{1}{2}$-inch elbow and nipple. The size of this pipe is too small to give standard sprinkler protection, and $\frac{3}{4}$-inch pipe should and probably could be used without serious results.

It is stated that the action of hot water on the iron pipe causes the segregation of nitrogen gas from the entangled air in the water, and this is a good non-conductor. The gas collects in the small offsets and after a period of time practically fills them. While this gas is a good insulator, the fact that the sprinkler heads do not open is primarily because the heat is radiated from the offset and from the head faster than it is supplied to them by conduction; also because there is no circulation in these offsets. While no heads have as yet opened from the heat of the system, the frames become so hot that one cannot bear the hand upon them for long without discomfort. The struts, however, are noticeably cooler than the frame. Whether this feature would be so marked in heads of other types is not known.

This system, slightly modified, is now being installed in a mill in Lewiston, Me.

Another system has recently been installed in a fireproof factory in Cambridge, Mass. This system was somewhat complicated by having two risers each containing a 6-inch alarm valve. The two systems were tied together above the alarm valves and so arranged that in order to shut off the flow from a sprinkler head it was necessary to close two sprinkler valves and one hot water valve. As it was not considered desirable to install an expansion tank at the top of the system, it was found necessary to make a connection through a small pipe to a domestic service connection so that the expansion and contraction could be properly cared for.

During an unusually cold spell, the heating system was forced in order to keep the building warm, and as a result two sprinklers opened from excessive heat. The offsets were then lengthened in an effort to avoid this trouble in the future. From this it would appear that in the present development of this scheme there is

some danger of sprinkler leakage losses occurring from these equipments.

The great advantage of such a system is obviously the saving in the cost of pipe in the original equipment, which saving has been estimated at thirty-three per cent.

The more important undesirable features are as follows:

1. Complication of valves. A hot water valve as well as the sprinkler valves must always be closed to shut off the flow of water.
2. Liability of more frequent shutting off of system for repairs.
3. Possibility of corroding and coating interior of the pipes on account of circulation of hot water.
4. Danger of sprinklers operating from excessive heat in pipes.
5. Possible interference with proper action of alarm valves due to action of hot water on rubber facings and to venting of system.

These possible defects would probably not offset the defects inherent in an ordinary dry system, and the system would therefore be of especial advantage in cold buildings that would otherwise have to be sprinklered on the dry system.

CHAPTER III

SPRINKLER SUPERVISORY SYSTEMS

The purpose of these systems is to give notice at a central station in case anything happens to a sprinkler system to seriously impair its effectiveness or in case there is a flowage in the pipes due to a break or to the opening of a sprinkler head. The signals are transmitted to a central station through a closed circuit system of wiring and there received on a bell and tape machine in a similar manner to thermostat signals. When a trouble signal is received a runner is sent from the central station to see that the proper remedies are applied.

This is a comparatively new form of protection, having been on the market only about eight years.

The rules of the National Board of Fire Underwriters (Signalling Systems, Class *H*) give definite requirements for many features of the wiring and central station and are as follows:

RULES OF THE NATIONAL BOARD OF FIRE UNDERWRITERS

Central Station.

(*a*) From the central office to the protected risk, there must be two (2) separate circuits one for the water flow alarm, and the other for the supervision features. Manuals must not be installed on the supervision circuit unless of approved non-interfering pattern.

(*b*) The central office must, at all times, be able to determine from the signal received, the particular feature of the sprinklered risk which is out of order and when it has been restored.

This may be accomplished by having separate transmitters for each feature of the service or distinctive signals from the same transmitter or by a combination of both methods.

Devices, Circuits, Etc.

(*a*) Must be so arranged that devices cannot easily be tampered with or removed without giving a signal in the central office.

(*b*) All circuits and electrical apparatus must comply with the requirements stated under Class A. It is, however, strongly recommended that all interior circuits be entirely run in approved conduit piping, wire to be such as is required in damp places, under Rule 3, Section *b*. Class *A*.

(*c*) All pipe connections to sprinkler system must be made in a workmanlike manner, equal in all respects to the regular standard required for sprinkler work.

(*d*) Not more than twenty-five (25) sets of transmitters or not exceeding one hundred (100) break wheels must be connected on a single circuit.

Tests.

Complete and satisfactory tests of all transmitters must be made by installing companies monthly and results reported to the Inspection Department having jurisdiction.

SUPERVISION DETAILS

Gate Valves.

(*a*) Connection, by means of approved devices, must be made to all gate or other stop valves, under control of the assured, in feed pipes to sprinklers, including all valves on tanks, fire pump, steam and discharge connections, city main connections, pump suction, post indicator valves, and where necessary, on small valves used in installation of the service. Devices to be so attached as not to interfere with the operation of the valve nor obstruct the view of indicator or access to stuffing boxes.

(*b*) Attachments on all valves must give a signal between the first and second revolutions of the hand wheel, tending to move the valve from its proper position, or when valve is not controlled by hand wheel, signal must be given before the valve has moved $\frac{1}{5}$ of the stem movement from its proper position.

Two separate and distinctive automatic signals will be required for the gate valve alarm, one signal to show that a valve has been removed from its normal position, and another distinctive and different signal to show that the valve has been returned to its normal position. The latter signal shall not be given until all valves have been returned to their normal position, or at least to the point where the first or trouble signal was given.

Pressure.

(*a*) All tanks or their sources of pressure, including steam supply for fire pumps, also pressure on dry pipe system, must be provided with separate and independent attachments, unless otherwise specified by the Inspection Department having jurisdiction.

Pipe to which supervisory devices are connected must be provided with a plugged test gauge connection and a stop and relief valve of satisfactory pattern; the whole to be so arranged that pressure on attachment and plugged connection can be released for testing purposes.

(*b*) Pressure tank attachment must give a high and low pressure signal at ten (10) pounds below and thirty (30) pounds above the normal pressure.

Steam pressure attachment must give a low pressure signal at 45 pounds.

Attachment to dry pipe pressure system must give a high and low pressure signal at ten (10) pounds variation above or below normal pressure.

In special cases and for other pressure sources, specific instructions must be obtained from the Inspection Department having jurisdiction.

Two separate and distinctive automatic signals will be required for pressure alarm, one to show that the pressure has gone below or above the required amount and another distinctive and different signal to show that the normal pressure has been restored.

Water Levels.

(*a*) All pressure and surge tanks, gravity tanks, cisterns and reservoirs used as a supply for sprinkler systems, must be equipped with separate and independent attachments unless otherwise specified by Inspection Department having jurisdiction.

All devices used for this purpose must be designed to withstand corrosion and possible mechanical obstructions.

(*b*) Must give a low water signal in all supplies, except pressure tanks, when water drops 12 inches below the required level. Pressure tank device must give a signal when water drops 4 inches below or rises 4 inches above the required level.

Two separate and distinctive automatic signals will be required for water alarm, one to show that water has changed from the required level, and another to show that the proper water level has been restored.

Temperature.

(*a*) All gravity tanks, cisterns and reservoirs for sprinkler service in which water might freeze, must be equipped with suitable temperature indicator, located two feet below the required water level.

Note: Where tanks, cisterns or reservoirs are located in houses in which water might freeze, Inspection Department having jurisdiction may require suitable temperature indicators for such houses.

(*b*) The indicator must give a separate and distinctive signal when temperature falls below 40° F., or rises above 160° F., and another distinctive and different signal to show that water has been restored to the proper temperature.

Fire Pumps.

Where automatic fire pumps are used a complete supervision shall be provided in each case, for which special instructions must be obtained.

Water Flow Alarm Details.

(*a*) At the base of each system riser, satisfactory and positive connections must be made by an approved device for indicating the flow of water in the sprinkler system, except that due to waste surges or variable pressure.

(*b*) The device must indicate at the Central Station any leak or flow of water in the sprinkler system, equal to or greater than at the rate of ten (10) gallons per minute.

Trouble signal to be distinctive and different from the water flow signal.

(*c*) Where any private local water flow alarm system is in use the supervisory water flow alarm must be so arranged that it shall not be dependent upon the operation of or interfered with by trouble on the local private alarm circuit.

Manual Alarms.

Where a sprinklered risk is provided with either a Central Station Water Flow or a Central Station Supervision Alarm, or both, and has not an approved and properly maintained Automatic Fire Alarm System, or Watchman's Central Station Time Recording System, a Manual Fire Alarm System installed in accordance with Rules 8 and 9 must be provided.

Signals and Reports.

(*a*) Arrangements must, if possible, be made by the operating company, by which they shall have access to premises under super-

vision, at all hours of the day and night. Where such arrangements cannot be made and it might become necessary to force an entrance to the building, a proper guard shall be placed over the building so long as required.

Note: It will, of course, be understood that all arrangements, under the above paragraph, should be made with the owner of the property and must be subject to the approval of the Inspection Department having jurisdiction.

(*b*) Arrangements must be made to furnish such reports of signals that may be received and in such form as may be required by the Inspection Department having jurisdiction.

Disposition of Signals.

(*a*) Upon receipt of signals referring to matters of purely equipment maintenance, the operating company must immediately send a runner to investigate and, if possible, see that the trouble is remedied at once.

They shall also notify the Assured by telephone or by the quickest method available.

Written notice should be given the Assured in all cases.

(*b*) Upon receipt of signals showing flow of water in the system, the central office must notify the nearest Insurance Patrol and such other parties as the Inspection Department having jurisdiction may require.

They shall also dispatch a runner to the risk.

They shall also notify the Assured by telephone or the quickest method available.

In addition to which, written notice should be given to the Assured.

Note: In all cases where notification is required to parties with whom private lines of communication have not been provided, the quickest available means of communication must be used.

(*c*) If, at any time, a combination signal is received, which from its nature, is indicative of water flow on the premises equipped, such combination signal must be treated by the central office as a fire alarm.

All manual alarms are to be treated as fire alarms.

Note: Fire alarms received from Sprinkler Supervisory service shall be transmitted to the city fire alarm office and patrol or such other places as required by the Inspection Department having jurisdiction, and should at all times be treated as still alarms.

LIMITATIONS OF THE SYSTEMS

Supplies from tanks and automatic pumps can be efficiently supervised but where a waterworks connection is the only source of supply the supervision is not as satisfactory. The gate valves from tanks and pumps are accessible and the supervisory attachment can be readily made; but it is usually impractical to supervise the underground waterworks valves on a sprinkler connection and it is certainly not practical to supervise all the street main gate valves, the closing of which might shut off water from the risk in question. It would always be possible, therefore, that the street main or even the sprinkler connection from the main might be shut off without giving any trouble alarm. A partial safeguard can be installed in the form of an alarm gage on the sprinkler system. This is adjusted so that when the water pressure drops to a certain predetermined point, say 25 per cent below normal, an alarm will be given. With this arrangement no fire could occur without some alarm being given through the supervisory system although the sprinkler system might be practically out of commission.

If the street connection was shut off it is probable that the pressure in the sprinkler system would gradually fall until a trouble alarm was given. If, however, the system was so tight that this did not occur, then in case of fire a sprinkler head would open and the pressure would at once drop and an alarm be given. While, therefore, the water supply might not be efficiently supervised the supervisory system would still act as a fire alarm. With a sprinkler supervisory system properly installed and maintained the sprinkler system is not only supervised so that the chance of failure in time of fire is reduced to a minimum but the system itself becomes an alarm service of the most efficient

type. This service may generally be considered the full equivalent of a thermostat system or standard watchman's service when efficiently maintained.

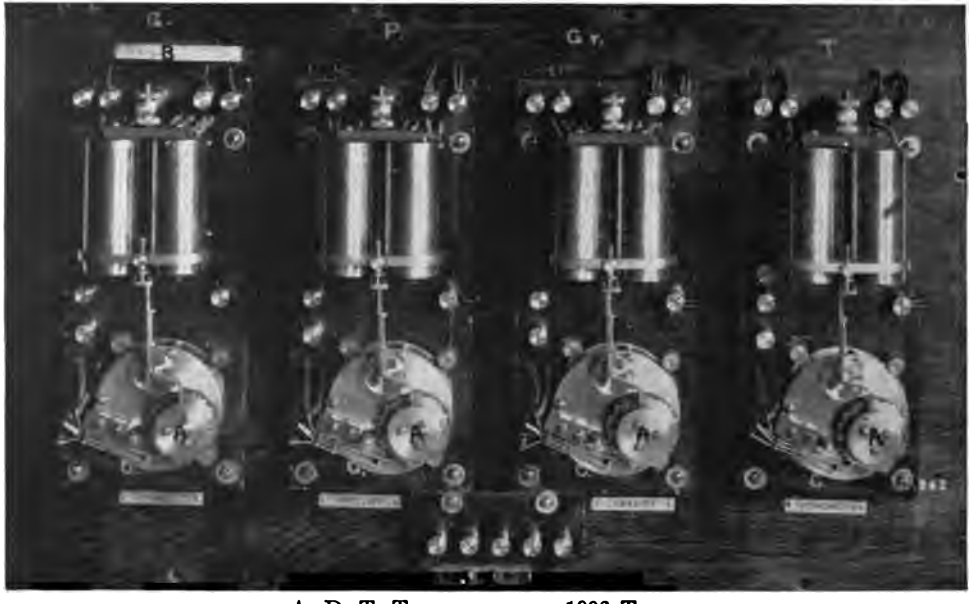
Supervisory systems must necessarily be confined to regions where there is a considerable number of sprinklered risks near together, probably to the larger cities and their suburbs, as it would not pay to go to the expense of equipping and maintaining an expensive central station in other places.

Up to a few years ago there were two systems on the market, the American District Telegraph Co. and the Consolidated Co., but at present only the A. D. T. system is being installed.

DESCRIPTION OF DEVICES

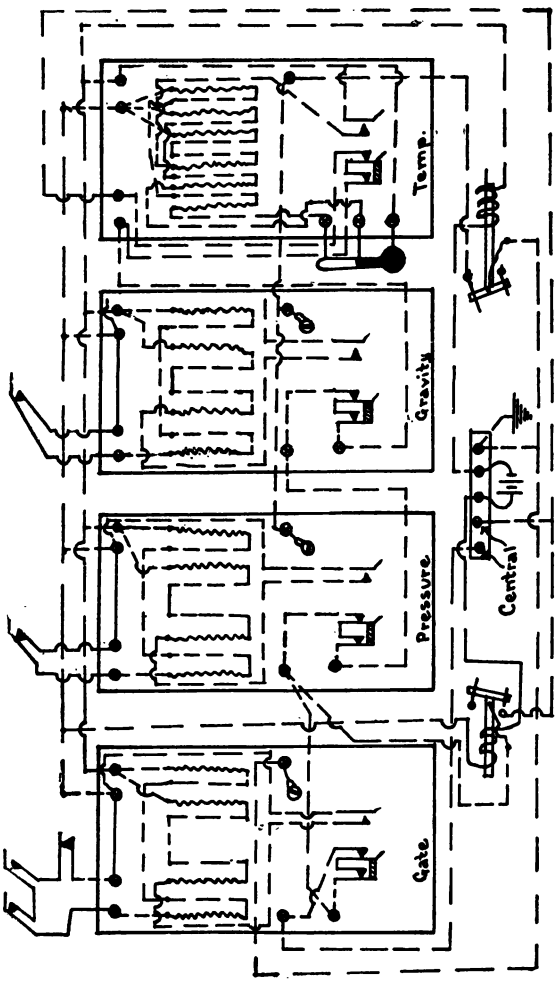
The devices consist in general of circuit breakers attached to check valves to give water flow alarm; gate valve attachments, pressure gages, water level attachments, temperature devices and the necessary transmitters, batteries, etc. All wiring is installed in conduit so that there is no chance to short circuit the system, thus putting the alarm connections out of service. The different attachments are securely fastened in place so that they cannot be disconnected without giving an alarm and they all have case contact or telltale attachments to prevent removing the cover and tampering with the interior mechanism without giving a trouble signal.

Water Flow Apparatus. The attachment for giving the water flow signals can be fastened to an alarm valve, or to any check valve provided it is slightly weighted. It consists of an arm pivoted near the middle in a bronze diaphragm. One end of the arm extends inside of the check valve to the under side of the clapper and is normally held down by the weight of the clapper.

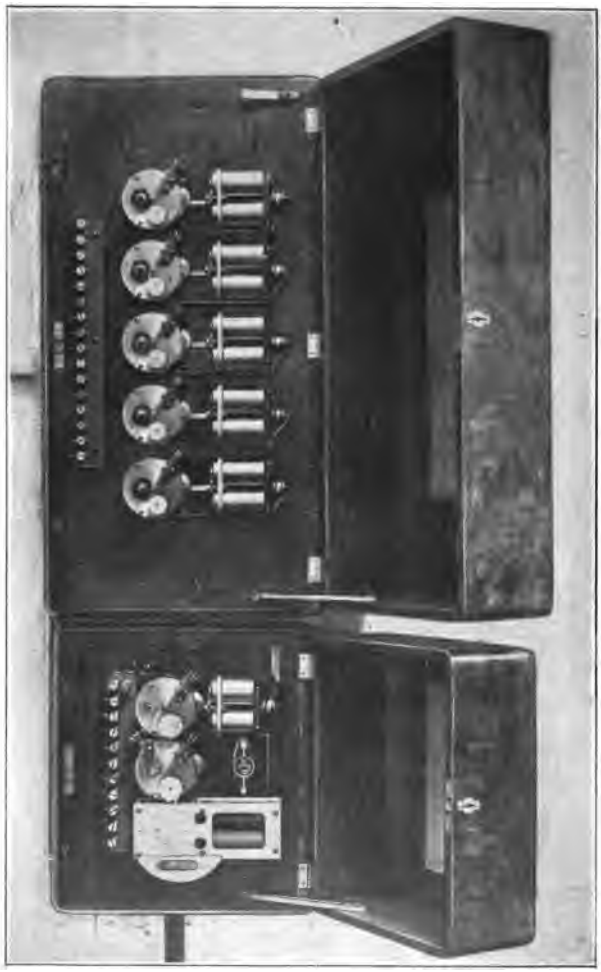


A. D. T. TRANSMITTERS. 1906 TYPE.

G, gate valve transmitter. P, pressure gage transmitter. Gr, water level transmitter. T, temperature transmitter. *a*, *a*, *a*, *a*, contact wheels and cams. *b*, case contact. *c*, *c*, *c*, *c*, contact springs, two sets one back of *other*.

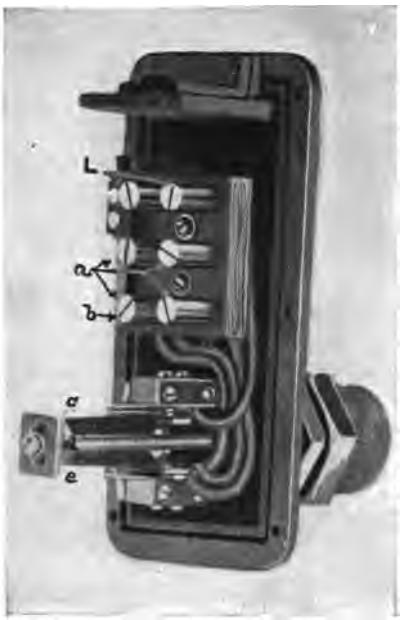


A. D. T. Plan of Supervisory Circuits.



A. L. T. Transmitters. Latest Type.

The other end of the arm carries an insulating ring which lifts a spring, thereby separating two platinum points. When there is a flow of water through the system the check valve rises, thus allowing one end of



A. D. T. Alarm Valve Apparatus.

a, binding screws for circuit wires.
L, binding screws for local bell wires.
b, case contact for telltale.
c, platinum contact points.
d, insulating ring or lever arm.
e, platinum points for local bell.

the arm to rise and make contact between the platinum points at the other end, the motion being transmitted through the flexible diaphragm. The making of the circuit by the platinum points starts a transmitter and

A. D. T. ALARM VALVE ATTACHMENT.

Contacts are in box at extreme left of picture. Wires run in conduit taken out at top of box. Manual alarm box at extreme right.

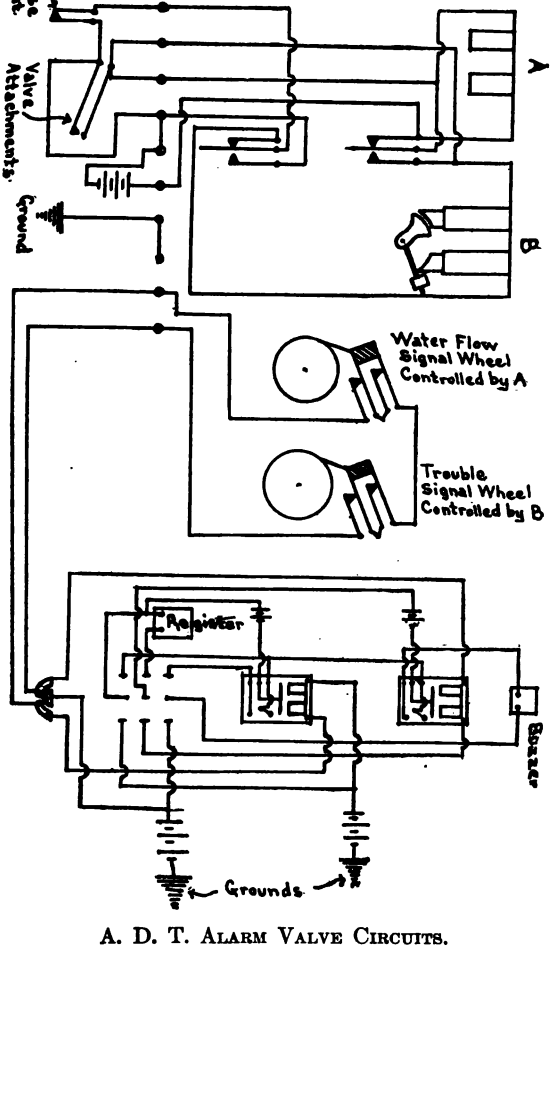
sends a signal to the central station. The platinum contacts are connected to the transmitter by two loops so as to insure safety and to indicate trouble. The case contact or telltale consists of a make-and-break contact in one of these loops which, when the cover is in place,

A. D. T. Alarm Valve Transmitter.

a, *a*, water flow signal magnets. *b*, device for causing wheel W. F. to make one full revolution when it starts. *c*, *c*, central station contact springs. *d*, springs for changing connections when wheel T has made one revolution. T, E, Time element magnet. W, F, water flow signal wheel. T, trouble signal wheel. *e*, cam for changing connections from T, E to *a*, *a*.

is held closed. When the cover is removed the circuit is broken and a trouble signal is sent to the central station.

The transmitter consists of two wheels, driven by clockwork, which are connected in series. One wheel is for trouble signals and one for water flow signals.



A. D. T. Alarm Valve Circuits.

The trouble signal is controlled by a time element device consisting of a large magnet energized by a local battery, and normally holding up its armature. When there is a water flow, the attachment on the check valve closes a short circuit around this magnet and allows this armature to fall. The fall of the armature is retarded by clockwork so timed that it will take longer than the duration of any ordinary hammer for the armature to complete its fall. When the short circuit is removed, the armature returns to its normal position; but if it lasts a sufficient length of time, as in case of a sprinkler head opening, the clockwork controlling the trouble wheel is released by the armature and one round of the box number is sent in short quick dashes to the central station. When this wheel completes one revolution it automatically changes the connections and closes the circuit through a second magnet which trips the clock controlling the water flow signal wheel and sends in three rounds of the box number.

If at any time the water flow should cease and the contacts in the check valve attachment open, the results would be as follows. If the short circuit was removed before the armature of the time element magnet completed its fall, the armature would return to its normal position and no signal would be transmitted. This prevents an alarm from being sent in when the water flow is of short duration such as would occur in case of water hammer. A small flowage, such as is caused by the operation of one sprinkler, would cause an intermittent action on the part of the check valve; that is the check would open for a short period and then close. In most cases the interval between the lifting and seating of the check is longer than the period of retard employed, so that while the alarm may be slightly delayed it will finally be given. In a small percentage of cases any adjustment of the retard ele-

ment that would prevent water hammer signals is likely to cause a failure to get the water flow signal. In such cases it has been necessary to maintain an excess pressure on the sprinkler system above the check valve so as to prevent any water hammer from raising the check. This can be easily done with a small hand pump or by connection to some pump furnishing pressure for other purposes. In order to maintain the pressure properly, a pressure gage is installed on the riser arranged to give notice at the central office when any considerable drop in pressure occurs. When such signals are received, the central office takes steps to restore the pressure to its original amount.

A. D. T. Dry Valve Attachment.

High and low air pressure alarm shown in circular case at left. Water flow switch connecting to intermediate chamber shown at right (white disc).

If the contacts did not open until the trouble wheel had started, this wheel would complete one revolution and then stop. A trouble signal would be received at the Central Station. In this case the armature of the time element would return to its normal position and the time element

would again be in service but no trouble signal would be transmitted until the box had been rewound. A second closing of the platinum points before the box had been rewound, as from water hammer, would send in a water flow signal, but not preceded, as ordinarily, by a trouble signal.

If the contacts did not open until the water flow signal wheel had started, one full round of the wheel or a complete water flow signal would be given before it stopped.

The entire system is wired on a loop, so that in case a wire is broken a trouble signal is received but the water flow signal is not crippled. The giving out of the battery causes a trouble signal to be sent in but no alarm can be transmitted until repairs have been made. The central station apparatus is arranged to indicate grounds and breaks on the outside line. A ground can be taken care of at the central station and it does not disable the circuit. A single break can be temporarily taken care of until repairs are made but two breaks in the line cut out all apparatus located between the breaks.

Gate Valve Attachment. This is a device which is clamped onto a gate valve and arranged to give a trouble alarm in case the valve should be closed or partially closed. The box is fastened to the yoke of the valve so that the rubber roller inside stands in the centre of the circle formed by the curves in two German silver springs. When in this position the platinum points on the ends of the springs are in contact and complete an electrical circuit. Another roller on the same spindle as the first, but outside of the box, fits into a groove in the valve stem. If the valve is turned a predetermined amount from the wide open position, the outside roller is moved sideways by the motion of the valve stem, thus causing the inside roller to be pushed to one side and opening the circuit. The amount of motion neces-

sary to do this can be adjusted as desired but in practice one complete revolution of the valve stem will push the springs apart and break the circuit. There is a telltale on this device similar to that on the water flow box which gives a trouble signal when the cover is removed. In case the whole box is removed, the spiral spring inside would move the rubber roller and force the con-

A. D. T. Gate Valve Attachment. Interior.

c, case. *d*, case contact. *e*, rubber roller. *f*, *f*, german silver springs. *g*, rubber post for closing case contact.

tacts apart, thus opening the circuit and giving a trouble signal.

The magnets for this device are operated by a local battery and are in multiple with those used in connection with the pressure, water level and temperature devices. There are separate transmitters for each of these devices and the central station circuit comes up to the number wheels on these. The wheels are operated by clockwork controlled by the magnets. There is

a loop around three of the magnets, normally held open by the local battery but which is closed if this battery circuit fails. The gate valve, pressure and gravity (water level) instruments are each connected in series with a double wound magnet, one circuit being normally open. This magnet normally holds up its armature but drops it when the circuit is opened by the instru-

A. D. T. Gate Valve Attachment. Rear.
a, roller that fits into slot in valve stem. *b*, clamp for fastening instrument to valve yoke. *c*, instrument case.

ment or by the removing of the cover, thus releasing the clockwork. When the armature drops, the clockwork sends in two rounds of the box number, the clock being then stopped by the lifting of the other armature on the magnet which is raised by the starting of the clock.

When the valve is again opened, the first winding is closed and the magnet is neutralized, thus dropping the

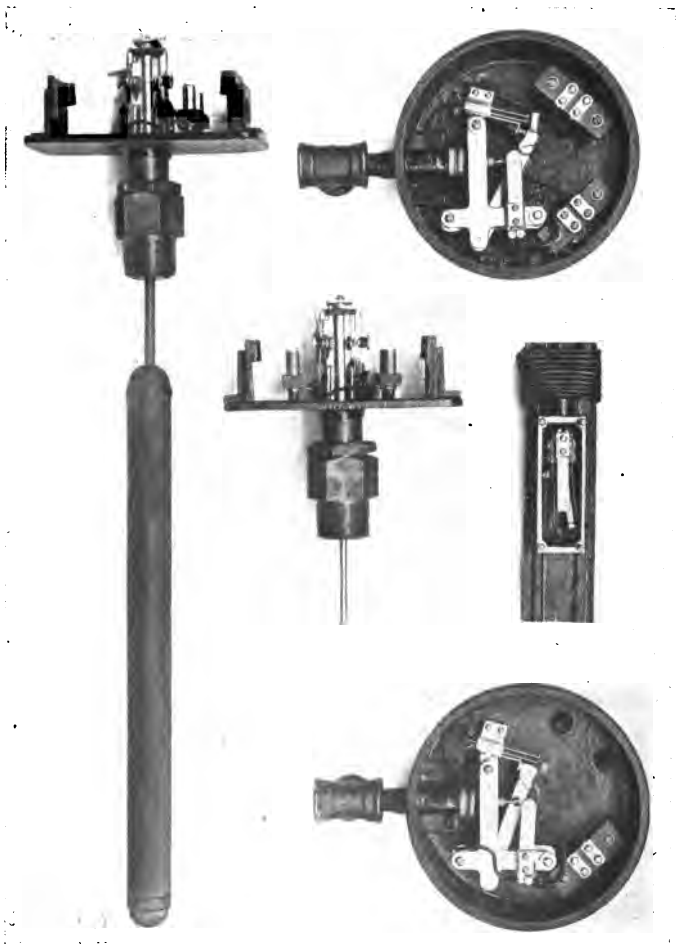
A. D. T. Gate Valve Attachment.
Showing attachment to an O. S. & Y. floor valve.
Wiring in flexible conduit.

armature and starting the clock. When the wheel starts, the second winding is opened and the armature

A. D. T. Pressure Device. 1906 Type. No longer used.
a, bourdon tube. *b*, lever operated by bourdon tube. *c*, contact springs. *d*, pipe connections to pressure tank or dry system. *e*, case contact.

is raised by the first winding and the clock is stopped at the end of one round.

Pressure Indicator. This consists of a metal diaphragm which supports a weighted lever. When this

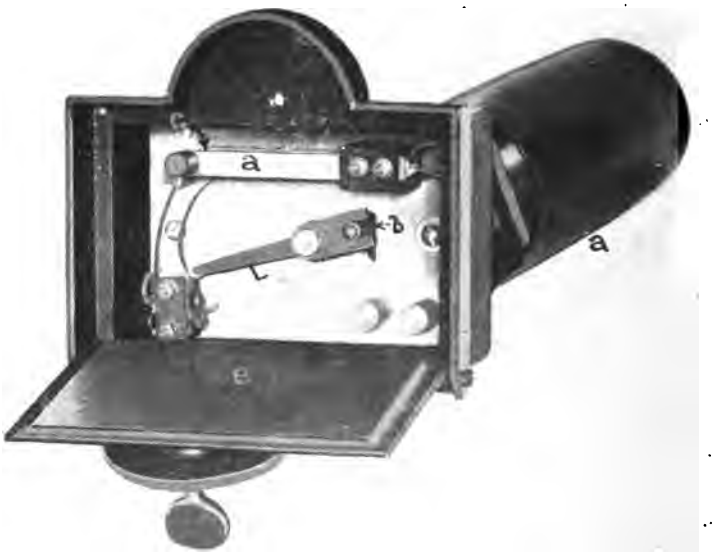


A. D. T. Supervisory Devices.

Water level float for pressure tanks, at left. Water flow switch for alarm valves, in centre. Large O. S. & Y. valve attachment, right centre. Water flow device for dry valves, upper right. High and low air pressure device, lower right.

A. D. T. Pressure Tank Attachments.
Water level alarm in rectangular box at left. High and low air pressure alarm in covered gage located at top of tank.

diaphragm is under pressure, the lever holds two electrical contacts together but when the pressure drops these contacts are opened. The opening pressure can be adjusted to suit any conditions. This replaces an instrument used till quite recently which contained a large bourdon spring as the acting mechanism.



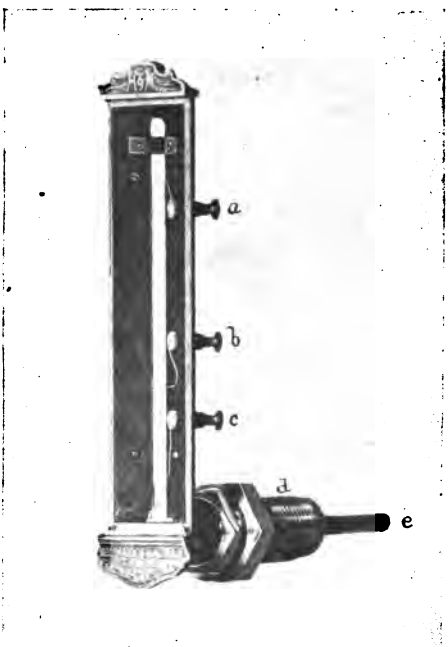
A. D. T. Water Level Device. 1906 Type. No longer used. *a*, case. *b*, lever attached to float. *c*, contact point. *d*, case contact springs. *e*, case cover. L, lever operated by float.

Water Level Device. This consists of a float inside of a perforated brass pipe which extends into the tank at the water level. A lever which is attached to a float and pivoted in a bronze diaphragm extends into a metal box. This lever ends in a small arm which when in its normal position holds two platinum contacts together.

A. D. T. GRAVITY TANK ATTACHMENTS.

Water level alarm at left. Temperature alarm at right.
Wiring in conduit.

When the float falls the lever is moved and the contacts are forced apart. There is a telltale on the cover to give a trouble signal when the cover is removed.



A. D. T. Temperature Device.

a, high temperature contact binding post. *b*, low temperature contact binding post. *c*, constant contact binding post. *d*, screw for fastening thermometer to side of tank. *e*, thermometer bulb.

The magnets and transmitter are similar to those used in the pressure indicator.

Temperature Device. This is a mercurial thermometer, the bulb of which extends through the side of the tank into the water. Three platinum wires are fused

into the glass tube, the upper one at about 180° F. to give a signal when the temperature nears boiling point; the middle one at about 40° F. to give a signal when the temperature nears the freezing point; the lower at a point where it will always be in contact with the mercury. When the temperature is normal, that is between 40° and 180° F., the circuit is closed through the lower wire running into the base of the mercury column, and the middle wire set to indicate freezing. If the temperature drops below 40° F. the circuit is broken at the middle wire. If the temperature rises above 180° F. a short circuit is made at the upper wire. There is also a tell-tale on the cover of this device.

The thermometer is connected to a triple wound magnet. The wire from the high temperature connection runs to the third winding and is normally an open circuit. When this circuit is closed, by the mercury reaching 180° F., the magnet is neutralized by the two opposite wound coils. The armature then drops and the clockwork is started. As soon as this happens the circuit of the remaining winding is closed, the magnet again becomes operative and raises the armature, thus stopping the clockwork at the end of two rounds. When the circuit of the high temperature winding is opened again the magnet becomes neutral, the armature drops and the clockwork is started. When this happens the second winding is opened and the third winding lifts the armature and stops the clock after one round. The low temperature alarm operates in a similar manner to the other devices.

A few systems were installed in which the local battery circuit contained two relays, one of which short circuited the central station pens of the instruments and the other removed the ground connection from the same instruments in case the local battery circuit failed. This allowed the gate valve instrument to send in an

uninterrupted signal (as all four instruments start on the failure of this battery) so that " central " would be able to locate and remedy the trouble. These have not, however, been found necessary and are not now being used.

SUPERVISION BY WATER FLOW

One of the prominent sprinkler companies is now working on a scheme for supervising gate valves by means of a bell and indicator located in the office or some other suitable place. The gate valves are fitted with a special attachment located in the bonnet which allows water to flow to a circuit closer whenever the valve is not wide open. This alarm is given in much the same way as with an alarm valve. When a valve is closed or partially closed, a grooved seat is uncovered and water flows through this to a circuit closer which operates a bell, an indicator and a red lamp. An automatic switch can be thrown to stop the ringing of the bell but this is returned to its normal position when the valve is opened.

APPENDIX I

Alphabetical List of Automatic Sprinklers

ADAM

Mm. Wauquier et cie, Lille, France.

Upright, valve sprinkler resembling the Grinnell glass disc in principle. Orifice a thin metal diaphragm closed by a glass disc. The strut is made up of several pieces and is adjustable. Small toothed deflector.

Not used outside of France so far as known.

ADKINS

Samuel Adkins, St. Louis, Mo.

1–1895. Valve sprinkler. Valve of agate held in place by levers in the form of a triangle.

ADKINS–1

ADKINS–2

2–1895. Valve sprinkler. Valve held in place by strut.

Both obsolete. Never used so far as known.

ÆTNA

See *"Automatic" Sprinkler Co. of America.*

ALBION

Greenwood & Batley, Ltd., England.

Upright, valve sprinkler. Metal valve disc held in place by toggle joint levers. Very similar to the International Sprinkler. Never used in America so far as known.

Now practically obsolete.

ALLEN

Made in *Bristol, Conn.*

1899. Upright, valve sprinkler. Metal valve cap held in place by strut. Large deflector.

Never used so far as known.

ALLEN AND REED

Allen and Reed, Providence, R. I.

1–1906. Upright valve sprinkler with strut. Cast-iron frame.

Never used to any extent.

Rating: *Questionable.*

ALLEN & REED 2.

2–1911. Upright, valve sprinkler almost a duplicate of the Grinnell glass disc head. A few were installed but soon afterwards removed.

Rating: *Questionable.*

3–1912. Similar to No. 2 but with strut split at the base.

Never used so far as known.

Rating: *Questionable.*

ALERT

See *Naylor.*

AMERICAN

American Sprinkler Co., Chicago, Ill.

1892. Valve held in place by horizontal arm. Arm held at each end by a soldered joint pinned to an angular projection. Perforated and slotted deflector. Threaded for a $\frac{3}{4}$-inch fitting.

Never used so far as known.

ASHCROFT

Edward H. Ashcroft, Lynn, Mass.

1886. Valve sprinkler with valve held in place by a strut threaded into a nut. The nut was soldered into a recess in the casting with low-fusing solder. Distribution from four arms pointing down and discharging onto four semi-spherical deflectors.

Never used so far as known.

ASSOCIATED

Associated Automatic Sprinkler Co., 2218 *Vine St., Philadelphia, Pa.*

A B

A–1913. Practically a duplicate of the International sprinkler except that the frame bulges more at the top

and the corrugations in the link are at an angle of 90 degrees.

Approved by the Underwriters' Laboratories, September, 1913.

Rating: *Standard.*

B–1914. Similar to *A* but with new deflector made of No. 14 B. & S. gauge bronze, containing 9 notches and 3 small holes. Upper end of compression screw practically flush with deflector. See page 53.

"AUTOMATIC" SPRINKLER CO. OF AMERICA

Executive Offices, 123 William St., New York.

This company was formed in May, 1911, and was a consolidation of the Manufacturers Automatic Sprinkler Co., the Niagara Fire Extinguisher Co. and the International Automatic Sprinkler Co. The company controls the following approved sprinklers: *Manufacturers, Niagara, International.* In 1913 this company started to manufacture the *Lapham B* sprinkler for the Ætna Fire Sprinkler Co. of Chicago, but it does not install the device.

See *Manufacturers, Niagara, International.*

BABCOCK

Patented by *E. F. Steck of Chicago.* Assigned to the *Fire Extinguisher Manufacturing Co. of Chicago.* Installed by this company from 1897 to 1904.

1900. This was an upright, valve sprinkler. Valve was hollow and held in place by a strut somewhat resembling that in the Grinnell glass disc head. Perforated deflector located inside the frame. Underwriters' Laboratories Report in 1902 criticized: (1) leaking point, (2) effects of corrosion and loading, (3) releasing device, (4) deflector, (5) disc, (6) structural weakness, (7) distribution, (8) solder in high test pattern.

A few thousand were installed but field experience was unsatisfactory.

Tests of the Underwriters' Bureau of New England between 1909 and 1912 of clean heads taken from the field; 9 failed out of 18 tested, and only 6 were in good condition. These heads have now been mostly replaced. They cannot be considered as giving good protection at present. See page 63.

Present rating: *Unreliable.*

See also Steck.

Note: There was a previous sprinkler patented in 1897 with a toothed deflector located on outside of frame. This was not used so far as known.

BACH

Patented by *N. S. Bach of Boston.*

1876. A rose sprinkler covered with a cap. The cap was held in place by four hinged levers. The levers were held together by a cord wound around them and then running to the adjacent head. The burning of the cord opened the heads.

Never used so far as known.

BARNES

Charles Barnes of Dayton, Ky., and Cincinnati, O. Some manufactured by *J. I. Covington* of the same city.

A-1879. Perforated bulb head with valve. Valve held in place by spindle which was threaded to a nut, the nut being soldered to the lower side of the casting. Never used so far as known. See page 25.

1-1881. Perforated bulb type. This was a valve sprinkler, the valve being held by a spindle resting against a hinged lever. The lever was held to the frame by a latch of low-fusing solder. Distribution was

from a perforated bulb and was therefore poor. Used to a very limited extent. Crude and subject to leakage; easily damaged and clogged. See page 25.

Obsolete.

Present rating: *Unreliable.*

(Section.)

2–1885. Long side lever type. This was a valve sprinkler, the valve being held in place by a long lever hooked to the frame at one end and attached to a projection on the frame by a link at the other end. Rotating deflector and valve were all one piece. Used to a moderate extent. Crude and easily damaged.

Obsolete.

Present rating: *Unreliable.*

BEECH

Patented by *Handel Beech of Oldham, England,* later of *Monson, Mass.* Bought out by *Dowson & Taylor Co.*

1899. Upright, valve sprinkler. Valve was a semi-spherical metal button and was held in place by a five-piece strut with small "sugar tongs" release. Threaded for $\frac{3}{4}$-inch fitting.

Underwriters' Laboratories Report 1905, criticized:

1. Susceptibility to corrosion and loading.
2. Lack of sharpness in operating.
3. Possibility of readjustment in the field.
4. Construction of seat.

Never used in this country so far as known.

BIRKETT

1883. Valve sprinkler with large hollow perforated distributor. Valve spindle held in place by horizontal bar soldered across a circular opening at the end of the casting.

Never used so far as known.

BISHOP

John W. Bishop, New Haven, Conn.

Bishop heads were installed by J. F. Gilbert & Co. of New Haven, Conn., as early as 1880. The risks of A. H. & C. B. Alling, Derby, Conn. and Montgomery Yarn Mills, Windsor Locks, Ct., were equipped about that time. Also the buildings of the Atlanta Exposition. Some Bishop heads were installed by Foskett & Bishop previous to 1882 and later the New Haven Automatic Sprinkler Co. and the New York & New Haven Automatic Sprinkler Co. installed these heads.

A–1879. Pendent, water-joint or " sealed " sprinkler. Slotted rotating distributor. Arrangement for letting out air in sprinkler pipe to prevent disturbance of alarm by momentum of water or water hammer. See page 26.


BISHOP–1

1–1883. Pendent, water-joint type. Interior slotted distributor. Cap about $\frac{1}{2}$-inch diameter soldered to outside of head. Direct strain on solder. See page 26.

1$\frac{1}{2}$–1883. Similar to No. 1 except that a thimble was soldered to the interior of the outlet instead of a cap on the outside. A slightly more sensitive head. Direct strain on solder. See page 26.

2–1884. Pendent, water-joint head. Thimble soldered to inside of outlet. Deflector with perforated edge held close to orifice by light spring. Pushed away by water when head opened. $\frac{3}{4}$-inch fitting. Direct strain on solder. See page 26.

BISHOP--2

BISHOP--2½

2¼–1884. Pendent, valve sprinkler. Valve spindle held in place by thimble soldered to inside of tube. Deflector with perforated edge held close to orifice. $\frac{3}{4}$-inch fitting. Direct strain on solder.

BISHOP--2½

BISHOP--3

BISHOP--3½

BISHOP--4

2½–1885. Similar to No. 2¼ except frame was all one casting. Threaded for $\frac{3}{4}$- or $\frac{1}{2}$-inch fitting. See page 45.

3–1885. Similar to No. 2½ except for circular piece below deflector. $\frac{1}{2}$- and $\frac{3}{4}$-inch fitting. Direct strain on solder. See page 46.

3½–1887. Patented by R. W. Miller and assigned to New York & New Haven Automatic Sprinkler Co. of New York. Pendent, valve sprinkler. Similar to No. 2½ except that valve stem rested against shoulders on two hinged levers. Levers held together by link.

4–1888. Similar in shape to No. 3 except that there were levers and link as in No. 3½.

The earlier types were subject to breaking open on account of the direct strain on the solder and were slow in action. Later types subject to corrosion. All types crude and easily stuck.

All obsolete.

Present rating: *Very unreliable.*

BISHOP

Joseph Bishop, Meriden, Conn.

1897. Valve sprinkler. Metal valve cap held in place by short toggle-joint levers secured by a solder pin. Large toothed and perforated deflector.

Never used so far as known.

BROWN

Joseph R. Brown, Bridgeport, Conn. Assigned to *Automatic Fire Extinguisher Co. of New York.* Manufactured by *Foskett & Bishop Co. of New Haven, Conn.*, and *Automatic Fire Alarm and Extinguisher Co. of New York.*


BROWN–1

1–1881. Pendent, valve sprinkler. Interior valve held in place by spindle running through interior guide and attached to deflector. Deflector soldered into conical shaped recess in base of casting. Was used to a considerable extent.

Very slow in operation. Crude and not sensitive. See page 30.

Obsolete.

Rating: *Unreliable.*

Note: There was apparently another and older type similar to No. 1 but of the water seal type without any interior valve. Probably never used.

2–1883. Pendent, valve sprinkler. Similar to above except that deflector was not soldered in place but was held by a strut and two hinged levers. Levers soldered together at lower side. See page 30.

Obsolete.

Rating: *Unreliable.*

3–1884. Pendent, valve sprinkler with two opposed outlets. Orifices closed by valves held by a single strut bearing on each valve. Probably not much used, if at all.

Obsolete.

Rating: *Unreliable.*

BROWN & FOSKETT

J. R. Brown and Wm. A. Foskett of New Haven.

1–1875. Elbow head with perforated distributor. Sealed by soldered disc insulated from the water by a core of non-conducting wax.

Never used so far as known.

2–1875. Elbow, valve sprinkler. Valve held in place by spindle bearing against cap soldered to end of casting. Coiled spring to assist in opening the valve. Solder under direct strain. See page 21.

Obsolete.

Rating: *Unreliable.*

BUEL

James Buel, Woburn, Mass.

1885. Pendent, valve sprinkler with deflector attached to valve stem. Deflector had raised perforated rim. Valve held in place by three horizontal hooked levers.

Never used so far as known.

BUELL

Charles E. Buell, New Haven, Conn. Afterwards of *Plainfield, N. J.* Installed by *Buell and Thompson, New York, Buell Automatic Alarm and Fire Extinguisher Co., Buell Electric & Hydraulic Manufacturing Co., New York,* and others.

The Buell system included dry valves and alarm valves; also some of the sprinklers had alarm attachments.


BUELL–1

1–1873. Pendent, elbow valve sprinkler. Valve held in place by stem bearing against a "sugar tongs" lever. Ends of levers soldered together and insulated from casting by chip of wood. Flat circular deflector. See page 24.

Obsolete.

Present rating: *Unreliable.*

1½–1884. Valve sprinkler with valve held in place by levers attached to fusible nut. Distribution from two arms with holes at upper and lower side opposite each other.


BUELL–2

Obsolete.

Rating: *Unreliable.*

2–1884. Pendent, valve sprinkler, of drop deflector type. Valve held closed by levers. Electric alarm attachment.

Obsolete.

Rating: *Unreliable.*

3–1884. Pendent, double outlet sprinkler of circular form, water feeding lower outlet from both directions. No deflector. Water distributed by two opposing streams striking each other. Both valves were held


BUELL–3


BUELL–4

closed by the same levers, one lever being soldered to a thin projection on the head. See page 46.

Obsolete.

Rating: *Unreliable.*

4–1885. Pendent, double outlet sprinkler similar to No. 3 except that frame was semi-circular and water


BUELL–5


BUELL–6

only came in one direction to lower outlet. See page 47.

Obsolete.

Rating: *Unreliable.*

5–1886. Pendent, valve sprinkler with fixed smooth deflector. Valve stem extended through deflector and

was held by hooked levers soldered together. Used extensively. See page 47.

Obsolete.

Present rating: *Unreliable.*

6–1892. Similar to above but a shorter head with a toothed deflector. Distribution defective under joisted construction. Used extensively. Recent tests show this head to be unreliable. Most of them have now been replaced.

Present rating: *Unreliable.*

7–1896. Upright valve sprinkler. Hollow valve cap held in place by two-piece strut.

Small scalloped deflector.

Never used as far as known.

Note: Mr. Buell patented several other sprinklers between 1905 and 1907 most of which were assigned to the General Fire Extinguisher Co. and were never used so far as known.

BURRITT

Albert M. Burritt, Waterbury, Conn. Made and installed by the *A. Burritt Hardware Co., Waterbury, Conn.*

1–1881. Water-joint sprinkler with perforated rose distributor. A thimble was soldered to the inside of the head. A loose cap covered the distributor to keep out dust. Crude and not sensitive. Direct strain on solder. See page 28.

Obsolete.

Rating: *Unreliable.*

Note: The patent, which was assigned to the A. Burritt Hardware Co., also covered an arrangement by which the thimble could be omitted and the cap soldered on to make the water joint. Also several other patents covering slight variations were taken out the same year.

2–1882. Similar to No. 1 but with open base; that is, the distributor was set a short distance away from the orifice by metal brackets. Crude and not sensitive. Direct strain on solder. See page 27.

Obsolete.

Rating: *Unreliable.*

3–1883. Sensitive or valve sprinkler. Valve held in place by spindle bearing against a lever which was hooked at one end and soldered to the frame at the other end. When open the water struck the valve and was thrown back against a slotted deflector. See page 28.

Obsolete.

Present rating: *Unreliable.*

All three types used to some extent.

BUTLER

1899. Drawings submitted to the Underwriters' Laboratories for approval by the National Fire Prevention Co. of Akron, Ohio. Several features criticized. Never made or installed so far as known.

CATARACT

Patented by *Charles W. Kersteter* in March, 1903.

Manufactured by the *Automatic Sprinkler Equipment Co. of Chicago, Ill.*

A–1906. Upright, valve sprinkler with diaphragm orifice. Valve disc seated on raised seat and was held in place by a strut. Large toothed deflector. Criticized by the Underwriters' Laboratories as follows:

1. Adhesion of cap.
2. Unreliability of releasing device.
3. Construction details.

Never used so far as known.
Rating: *Unreliable.*


CATARACT–A


CATARACT–B

B–1907. Similar to type *A* but with a modified form of deflector and strut. Tests showed unreliability of releasing device.
Never used so far as known.
Rating: *Unreliable.*

CLAPP

Joseph Clapp, Evanston, Ill.
Manufactured by the *Clapp Automatic Sprinkler Co. of Chicago, Ill.*

1–1887. Single-arm type. Upright, valve sprinkler. Valve held in place by lever attached to frame by small link. Fixed deflector supported by arm. Used to some extent in this and a slightly modified form. Easily damaged. Faulty distribution. See page 48.

Out of 55 recently tested by the Underwriters' Laboratories 17% failed.

Obsolete.

Present rating: *Unreliable.*

1½–1889. Upright, valve sprinkler of modern design. Valve cap held in place by strut consisting of several pieces. Fixed cone shaped deflector. Never used so far as known.

2–1890. Similar to No. 1½ but with flat three-piece strut and flatter deflector. Used to considerable extent. Largely replaced. See page 48.

Present rating: *Doubtful.*

CLARK & COOPER

Patented by *W. L. Cooper, Spigners, Ala.*, 1903.
Manufactured by *Globe Cotton Mills, Augusta, Ga.*

1904. Upright, valve sprinkler. Valve was of glass or hard rubber and of spherical form. It was held in place by a lever hooked at the lower end and soldered at the upper end. The solder joint was reinforced by solder rivets. Deflector held by an arm. Submitted to Underwriters' Laboratories and practically all features were criticized. Never used so far as known.

CLAYTON

E. S. Clayton, Newark, N. J.
Independent Fire Extinguisher Co.

1906. Upright, valve sprinkler. Diaphragm with raised seat. Metal valve disc held in orifice by strut with a horizontal projection.

Never used so far as known.

COMINS

Frank B. Comins, New Bedford, Mass.

1885. Valve sprinkler with conical shaped valve disc and fixed deflector. Valve held in place by two piece lever soldered to projection on casting.

Never used so far as known.

CONANT

Hezekiah Conant, Pawtucket, R. I.

1875. Valve sprinkler with perforated rose distributor. Globe type of valve used, the spindle being horizontal and held in place by light combustible cord. Operated by burning of cord. Also knife attachment with handle hanging down for cutting the cord by hand. Installed only at Mr. Conant's thread mill in Pawtucket. But few made. See page 22.

Obsolete.

Present rating: *Very unreliable.*

COOK

See *Kersteter.*

CROWDER

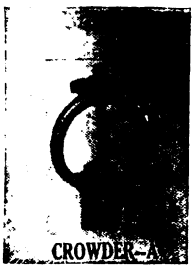
Crowder Bros., St. Louis, Mo.

1903–1908. Eight experimental samples submitted for approval. All were criticized by the Underwriters' Laboratories.

Never used so far as known.

A–1909. Upright, valve sprinkler somewhat resembling the International Sprinkler except in the construction of the link which consists of two flat plates $\frac{3}{4}$ inch wide with opposed grooves filled with solder.

Rating: *Standard.*



DALY

M. J. Daly & Sons, Waterbury, Conn.

1899. Valve sprinkler. Metal valve disc with mica washer held in place by adjusting screw passing through a horizontal lever. One end of lever hooked to inside of frame. The other end held by fusible strut under compression. Loose revolving deflector.

Never used so far as known.

DANIELS

1896. Upright, valve sprinkler. Metal valve disc held by strut. Large revolving deflector.

Never used so far as known.

DETROIT

Detroit Sprinkler and Chemical Fire Extinguisher Co., Chicago, Ill.

1903. Upright, valve sprinkler. Metal valve disc held by strut similar to that in the Clapp sprinkler. Small slotted deflector attached to the inside of the frame.

Never used so far as known.

DIXON

John H. Dixon, Erie, Pa.

1–1903. Upright, valve sprinkler. Valve and deflector in one piece. Interior spindle held by guide. Undeveloped experimental device submitted to the Underwriters' Laboratories for approval. Practically all features criticized.

Never used so far as known.

2–1904. Altered sample submitted for approval. Practically all features criticized.

Never used so far as known.

DODGE

1904. Upright, valve sprinkler. Valve cap held in place by curved levers, attached to a projection at the top of the frame by a fusible member. Toothed deflector attached to inside of frame.

Never used.

DORAIS

Evan Almivall & Co., New York.

1910. Upright, valve sprinkler. Metal valve disc held in place by levers. End of levers held apart by a compression strut composed of several pieces. Toothed deflector attached to inside of frame.

Never used so far as known.

DOUBLE LOCK

The Double Lock Automatic Sprinkler Co., Chicago, Ill.

1911. Upright, valve sprinkler. Metal valve disc held by levers. Ends of levers held apart by a compression strut similar to that in Dorais. Criticized by Underwriters' Laboratories in July 1911, as follows:

DOUBLE LOCK.

1. Principles of operation.
2. Reliability of operation.
3. Effects of loading and corrosion.
4. Possibility of premature opening.
5. Inability to withstand ordinary abuse.
6. Distribution.
7. Lack of uniformity of manufacture.
8. Construction details.

Never used so far as known.

DRAPER

1884. Patented by *F. H. Prentiss of Boston.*

1890. Patented by *A. T. Gifford.*

1884. Made by the Draper Co. of Hopedale, Mass. Interior valve opening against water pressure. Valve

(Differential.)

spindle extended to the upper side of a small closed receptacle with corrugated sides containing volatile hydrocarbon. When the contents expanded from heat the sides were forced apart and the valve was thrown up from its seat. Water distributed from a flat plate with a thin corrugated ring to break up the stream. Used to a limited extent and submitted for approval

in England under the name Draper-Hetherington. Extremely subject to corrosion. See page 34.

Obsolete.

Rating: *Very unreliable.*

1889. *" Differential " type.* Valve sprinkler, the device being in the form of a cross pipe fitting with a valve and orifice at the lower end. Valve held in place by spindle soldered to a sleeve entering vertically from the top of the device. Flat iron deflector supported in front of orifice.

An attempt was also made to use bitumen instead of solder to make the device more sensitive. This was not a success as it was not strong enough. A few were put on the market.

Obsolete.

Rating: *Unreliable.*

ESTY

William Esty, Laconia, N.H. Made by *Esty Sprinkler Co. of Laconia, N.H. Installed by H. G. Vogel Co., New York, and others.*

1–1895. *Plain.* Upright, valve sprinkler. Metal valve cap, with oiled paper washer, held in place by duck-bill levers. Flat surfaces soldered together. Revolving deflector perforated and toothed. See page 62.

2–1895. *Corrugated.* Same as No. 1 but with soldered surfaces of duck-bill corrugated.

3–1895. *Cone.* Same as No. 1 but with cone or knob soldered to outer end of duck bill.

4–1895. *Pin.* Same as No. 1 but with solder pin extending through ends of duck bill.

4½–1895. Same as No. 1 but with bent wire soldered over end of duck bill.

All the above types were experimental and but little used. Liable to open prematurely.

Rating: *Unreliable.*

5–1896. *Spring.* Same as No. 1 but with cavity cut between duck bills in which was inserted a steel spring. Cavity filled with wax except in the high test heads. Solder joint strengthened by a wire running under a ledge on the lower duck bill and over a groove in the end of the upper duck bill.

Criticized by the Underwriters' Laboratories as follows:

1. Releasing device.
2. Solder in high degree pattern.
3. Disc.
4. Cap.

Generally approved by local boards. Field experience fairly satisfactory. Not defective except in corrosive locations. Distribution unusually good. See page 62.

Rating: *Not standard, generally satisfactory.*

6–1903. Similar to No. 5 but with fixed deflector.

Underwriters' Laboratories Report, 1904, makes similar criticism as for No. 5. Field experience fairly satisfactory. Not standard but not considered defective.

Rating: *Not standard, generally satisfactory.*

B–1912. Similar to No. 6 except no knob above deflector. Four small knobs cast on edge of valve cap slightly overlapping the valve seat. Slight change in solder joint.

Approved by the Factory Mutual Insurance Companies. Not approved by the Underwriters' Laboratories.

Rating: *Not standard, generally satisfactory.*

Note: Mr. Esty took out patents on several other types of heads notably: 1903 valve sprinkler with valve held by two parallel struts about 1 inch apart. 1907 valve disc held by toggle-joint levers and link as in International head. 1909 strut sprinkler with circular frame.

These later types were never used so far as known.

EVANS

Merchant & Evans Co., Philadelphia, Pa.


EVANS.

A–1913. Upright, valve sprinkler somewhat resembling the International sprinkler. Two-piece metal valve cap held in place by toggle-joint levers and link. Link composed of two flat plates $\frac{3}{4}$-inch wide containing two opposed angular depressions in which is inserted a key.

Approved by the Underwriters' Laboratories in Jan., 1914. See page 55.

Rating: *Standard.*

FOWLER

Walter B. Fowler, Lawrence, Mass.

1884. Pendent, valve sprinkler with fixed deflector. Valve spindle extended through hole in deflector and was held by two hinged levers. Released by I-shaped piece of solder under tension.

Another type had a loose ring covering a series of radial holes through which the water issued, the water raising the ring slightly.

A few of these sprinklers were installed in eastern Massachusetts. Field experience fairly satisfactory for a few years.

Now obsolete.

Present rating: *Unreliable.*

GARTH

Garth Co., Toronto, Canada.

1911. Valve sprinkler with frame resembling the Esty sprinkler. Metal valve disc with mica washer held in place by long duck bill levers overlapping and soldered together at end. Small rotating deflector.

GARRETT

Chas. B. Garrett, Cincinnati, Ohio, formerly of *Minneapolis, Minn.*
Manufactured and installed by the *Globe Automatic Sprinkler Co., Cincinnati, Ohio.*

1904–1910. Upright, valve sprinklers of the strut pattern. Experimental samples submitted to the Underwriters' Laboratories and reported on in December, 1904, May, 1906, June, 1906, August, 1906, February, 1907, July, 1907, and May, 1908.

A few of the 1904 pattern were installed in the State of Washington but nowhere else so far as known.

Rating: *Unreliable.*

GARRETT-GLOBE A

1911. Upright, valve sprinkler with strut. Approved in 1911 by the Underwriters' Laboratories.

Rating: *Standard.*

GLAZIER

J. T. and C. C. Glazier, Indianapolis, Ind. Assigned to *Glazier Nozzle & Manufacturing Co.*

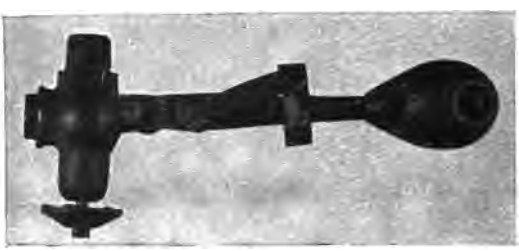
1905. Small rotating Glazier nozzle with two radial outlets at a slight angle. Perforations in centre of casting between nozzles. Mounted on a casting containing two right angle turns. Interior valve seated vertically and held in place by horizontal stem connected to a hinged lever one end of which was soldered in place.

Never used so far as known.

GLEASON

Elliott P. Gleason, New York.

1888. Pendent, interior valve sprinkler of the Globe valve type. Valve opened against water pressure.



GLEASON.

Rotating deflector. Weighted lever, connected to packed stem extending from valve to outside of casting. The weight was held up by a cord containing a two-piece fusible link. When link melted the weight dropped, opening the valve and starting a train of clockwork which gave an alarm. Not a reliable type of sprinkler.

Never used so far as known.

In another type no cord was used but weight was held by a hinged arm. A link held this arm to a projection on the casting.

GLOBE

See Garrett.

GLOBE.

GLOBE. (Side View.)

GORTON

English Sprinkler.

Diaphragm sprinkler similar to the Grinnell glass disc head. Approved and used in South Africa.

Not approved in England.

GOUZÉ.

GOUZÉ

M. Gouzé, Nantes, France.

Valve sprinkler. Valve disc held by lever hooked at one end and soldered to frame at other end. Toothed deflector supported by an arm.

The Gouzé system includes a water supply consisting of pressure tanks normally under no pressure. Bottles of carbonic acid gas are brought into play when the system operates, thus supplying the necessary pressure.

Used in France but nowhere else so far as known.

GRANGER

A. M. Granger, Boston, afterwards of *Buffalo, N. Y.*

1–1881. Valve sprinkler of elbow type with rotary turbine distributor. Valve held in place by heavy spring, bearing against the valve and against a nut held in place by fusible solder. Probably not used to any extent. See page 29.

Obsolete.

Present Rating: *Unreliable.*

2–1885. Valve sprinkler with rotating deflector attached to valve. Valve held in place by lever somewhat similar to that in the Walworth head. Lever held to projection on casting by a rectangular link. Not much used so far as known.

Obsolete.

Present rating: *Unreliable.*

3–1886. Slight modification of No. 2.

Present rating: *Unreliable.*

GRAY

Frank Gray.

Installed by *Edward Barr Co., New York.*

Manufactured by *Insurers Automatic Sprinkler Co., New York.*

1– About 1884. Pendent, valve sprinkler. Valve held in place by stem extending down into hollow tube and resting against thimble soldered into lower end of tube. ¾-inch fitting. Solder under direct stress. See page 49.

2– About 1886. Very similar to No. 1 but with arms of frame at a slight angle.

Both crude and easily stuck. Distribution faulty. A considerable number were installed mostly on the Gray dry system. See page 49.

Obsolete.

Present rating: *Very unreliable.*

3–1899. F. Gray and Charles D. Cox of Chicago patented an upright valve sprinkler. Valve held in place by 4-piece strut. Large perforated deflector.

Never used so far as known.


GRAY–1


GRAY–1½


GRAY–2

4–1904. Upright, valve sprinkler. Perforated deflector on outside of frame. Valve disc held in place by toggle-joint levers and link.

Never used so far as known.

Note: There were several other types of Gray sprinklers varying but little from one another. Also one having a soldered lever for a releasing device.

GREW

English Sprinkler.

1900. Submitted to Underwriters' Laboratories, Chicago, in 1900. Found to be inoperative in test. All features criticized.

A large cylindrical sprinkler.

Never used in this country so far as known.

GRINNELL

Patented by *Frederick Grinnell, Providence, R. I.*

Installed by *Providence Steam & Gas Pipe Co.* up to 1893, after which time by the *General Fire Extinguisher Co.* Over 18,000,000 have been installed.

1–1881. Pendent, valve sprinkler. Valve and deflector all one piece. Valve disc seated on raised ring $\frac{1}{8}$ inch wide in a thin metal diaphragm. Diameter of outlet $\frac{7}{16}$ inch. Stiff plate under diaphragm. Valve held in place by yoke and lever, the yoke being hooked under a notch in the frame and the lever being hooked under a similar notch on the other side. Lever soldered to frame with no reinforcing key. Later the end of the lever was bent over the frame to give greater strength. Deflector had 20 teeth or lobes.

A–1882. Same as No. 1, except a key was used to strengthen solder joint. Deflector had 24 teeth.

In 1883 orifice was enlarged to $\frac{1}{2}$ inch. Valve disc of lead. Seat ring $\frac{1}{8}$ inch wide.

B–1884. Same as *A*, except seat ring was $\frac{3}{32}$ inch wide. Valve disc of tin.

UPRIGHT.

C–1886. Same as *B*, except seat ring was $\frac{1}{32}$ inch wide. In December, 1886, upright heads of this type with perforations in the deflector were first made.

D–1888. Similar to *C*, except babbitt metal was used for the valve disc and seat ring was $\frac{3}{64}$ inch wide. Recess in deflector for the valve disc was $\frac{5}{8}$ inch in diameter while in the older types it was $\frac{7}{8}$ inch. Upright heads of this type were also made, there being holes in the deflector.

About 1895 the issue *C* type was found to be defective as the narrow seat ring caused indentation of the valve disc and sticking of the valve. About ten years later the *A* and *B* types were rated as unreliable on account of sticking at the seat and sticking of the levers. A few years later the issue *D* type was quite generally condemned for the same reason so that today all these heads having given good service for twenty years or more are considered defective. Nearly all have now been replaced. A few have opened prematurely on account of weakness of solder joint. See page 39.

Present rating of all Grinnell metal disc sprinklers: *Unreliable.*

Glass Disc 1890. Upright, valve sprinkler. Heavy diaphragm with ½-inch orifice. Valve of glass and semi-spherical in shape. Releasing device in the form of a three-piece strut.

GLASS DISC.

IMPROVED.

In the earliest heads the strut was narrow and with parallel sides. Later it was widened and made bulging in the middle. Key slightly changed in 1893.

In 1897 the material of the " hook " in the strut was changed from German silver to bronze and it was made thicker. This was done on account of some breaking and cracking at this point.

Some trouble was also caused by cracking of the glass disc. After 1896 annealed glass (with a bubble) was

used which obviated all trouble. After 1894 metal discs were used in high test heads. Field experience satisfactory except in some of the earlier heads. See page 64.

Rating: *Generally reliable.*

Improved 1903. Similar to previous type but with heavier deflector containing fewer teeth. Approved by the Underwriters' Laboratories in 1903.

Rating: *Standard.*

Picker Trunk, 1903. Provided with longer base casting and smooth deflector for use in picker trunks and conveyors.

Rating: *Standard.*

Glass Cover, 1912. Releasing device protected by a glass cover fitting into a groove filled with non-drying compound, in the body of the casting. For use in corrosive locations. See page 79.

Rating: *Standard.*

GUNN

John Gunn, Webster, Mass.

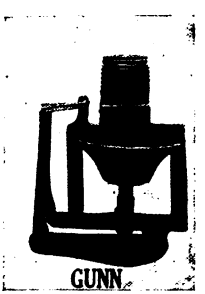
1885. Pendent, valve sprinkler. Drop deflector type. Valve held in place by hinged levers fastened to projection on casting by a fusible link.

Deep cup-shaped deflector.

Used to a limited extent locally.

Obsolete.

Present rating: *Unreliable.*



HARKNESS

Patented by *Wm. Harkness, New York.* Installed by *Harkness Fire Extinguisher Co., New York.* Some systems installed with non-freezing solution normally in the pipes.

A–1885. Pendent, valve sprinkler of drop deflector type. Deflector had teeth on the edge and soft metal

valve disc in the middle. Valve held in place by cross-shaped strut, the two horizontal arms being soldered to the frame. A small spring tended to throw out the vertical members, when solder fused. Threaded for ¾-inch fitting. Never used so far as known.

1–1887. Similar to above but strut held in place by horizontal lever soldered to a projection on the frame. Threaded for ¾-inch fitting. See page 51.

Present rating: *Unreliable.*


HARKNESS–1


HARKNESS–2


HARKNESS–3

2–1889. "L" joint. Smaller head than No. 1 threaded for ½-inch fitting. Valve covered a hole in circular diaphragm. Valve stem held by bent horizontal lever and small ball. Lever soldered to projection on frame by L-shaped joint. Large fixed deflector with teeth on the edge.

Present rating: *Unreliable.*

3–1890. Same as No. 2 but with rectangular-shaped solder joint.

Present rating: *Unreliable.*

4–1894. Same as No. 2 with V-shaped joint.

Present rating: *Unreliable.*

Field experience of all types fairly satisfactory. Now practically obsolete.


HARKNESS–4

HARRIS

Patented by *A. S. Harris, Chelsea, Mass.*

1–1881. Water-joint type. Cap soldered over perforated distributor.

Never used so far as known.

2–1882. Pendent, valve sprinkler. Hollow valve stem extended to bottom of casting and was soldered to two small strips of metal projecting downward. Water distributed through perforations protected by a loose cap. Never used so far as known. See page 31.

3–1883. Pendent, valve sprinkler with toothed deflector. Valve stem extended through hollow tube and was held by a thimble soldered into end of tube. Direct strain on solder joint. See page 31.

Some of these heads were installed by the Walworth Manufacturing Co. previous to the manufacture of the Walworth head.

Obsolete.

Present rating: *Unreliable.*

HARRIS

HARRISON

HARRISON

Stuart Harrison, England.

1864. Pendent, valve sprinkler with rose distributor. Soft rubber cup-shaped valve held in place by stem

bearing against a solder joint. Solder insulated from main casting by a projection of hard wood.

Never used so far as known but a remarkably good sprinkler for that date. See page 14.

HEATH

Ozro C. Heath, Providence, R. I.

1–1881. Pendent, water-joint type with revolving distributor. Cap fastened to top of head by means of fusible pins.

2–1882. Pendent, valve sprinkler with fixed toothed deflector. Valve held in place by stem threaded to a nut, the latter being soldered to a hole in the frame.

3–1882. Pendent, valve sprinkler with similar distributor. Cap was screwed onto a collar, the collar being attached to the head by low-fusing solder. This enabled the cap to be unscrewed from the collar in order to examine the interior of the head.

None of these heads were ever used so far as known.

HIBBARD

Geo. E. Hibbard, Chicago, Ill.

Manufactured by *Geo. E. Hibbard, Chicago; Geo. E. Hibbard & Co., Chicago; American Fire Extinguisher Co., Chicago; National Fire Extinguisher Co., Kansas City; Niagara Fire Extinguisher Co., Akron, Ohio.*

Installed by *Mallers, Allen and Frazier, Chicago; Francis Bros. and Jellett, Philadelphia; Macauley Bros., Grand Rapids, Mich.; W. H. Littlefield, San Francisco; Bowles and Warwick, Richmond, Va.;* and *W. T. Montgomery, Boston.*

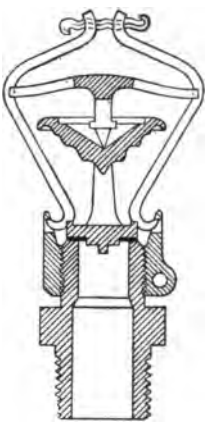
1–1893. Upright, valve sprinkler. Valve held in place by two hooked levers bearing on edge of valve cap and extending around edge of deflector to top of sprinkler.

Levers held together by a two-piece fusible link either straight or corrugated. Fixed conical-shaped deflector. First installed in vicinity of Cincinnati but these have probably all been replaced. See page 49.

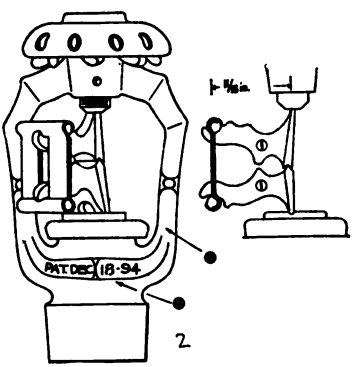
Obsolete.

Rating: *Unreliable.*

2–1894. Upright, valve sprinkler. Hollow valve button held in place by short levers, almost on dead centre, and two-piece straight link. Hexagonal wrench head. Lower lever had an arched lower bearing. Two-piece fusible link. Seriously affected by corrosion.



HIBBARD 1.
(Section.)



HIBBARD 2.

Structurally weak. Not approved, but a good many in use. Field experience only fair. Age limit about reached. Tests should be made to determine reliability.

Out of 25 recently tested by the Underwriters' Laboratories 12% failed, partly due to levers being on dead centre. See page 49.

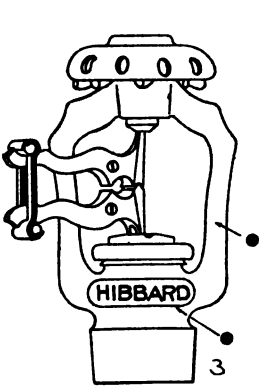
Rating: *Uncertain.*

3–1897. Same as No. 2 except for longer levers, square wrench head, and heavier frame. Seriously

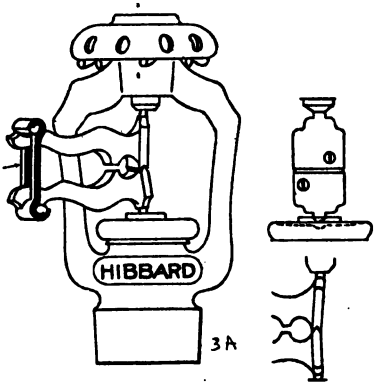
affected by corrosion and loading. Paper discs in some samples. Caps and discs liable to adhere to seats. Field experience fairly satisfactory. Tests should be made on heads from each equipment to determine reliability.

Out of 129 recently tested by the Underwriters' Laboratories, 40% failed, partly due to levers on dead centre.

Rating: *Unreliable.*



HIBBARD 3.



HIBBARD 3A.

3A–1898. Same as No. 3 except for pivoted lower bearing on lower lever and temperature and date marks usually found on fusible link. Same defects as in No. 3. Soft white metal gasket under valve. This is liable to stick to seat and cut down the discharge about 20 per cent.

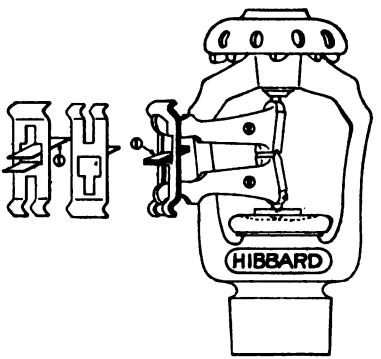
Out of 291 recently tested by the Underwriters' Laboratories, 19% failed from adhesion at seat, etc.

Rating: *Unreliable.*

4–1901. Same as No. 3 *A* except for cross piece in fusible link and straight arm levers. Manufactured by Niagara Fire Extinguisher Co. only and used mostly in the West. Especially subject to corrosion.

Out of 110 recently tested by the Underwriters' Laboratories, 11% failed.

Rating: *Uncertain.*



HIBBARD 4.

5–1909. Similar to Niagara-Hibbard *B* except that "Nia-Hib" on wrench head was changed to "Hibbard." Manufactured by Geo. E. Hibbard & Co., Chicago. Not approved.

Rating: *Uncertain.*

I–1911. Upright, valve sprinkler, very similar to Niagara Hibbard *B* except for fins on lower end of arms of casting to give means for distinguishing the head. Manufactured by Geo. E. Hibbard & Co., Chicago. Approved by Underwriters' Laboratories April, 1911. Withdrawn Oct., 1912. Manufacture discontinued. Used principally in Middle West.

Rating: *Satisfactory.*

HILL

John Hill, Columbus, Ga.

Manufactured by *John Hill and by Hill Automatic Sprinkler Co. of Columbus, Ga.* Later by *Neracher & Hill Sprinkler Co., Warren, Ohio,* and *General Fire Extinguisher Co.*

1890. Pendent, valve sprinkler. Oscillating deflector. Has restricted discharge and is somewhat subject to leakage owing to spreading of solder joint. Not standard. Field experience generally satisfactory. Has now about reached its age limit and recent tests show frequent failures.

Out of 81 heads of the light pattern recently tested by the Underwriters' Laboratories, 11% failed. See page 48.

Present rating: *Uncertain.*

Note: This head was first patented in 1885 and was slightly modified in patents taken out in 1887, 1890 and 1892. Several types were made varying but slightly from one another.

Mr. Hill combined with William Neracher in 1890 and the business was moved from Atlanta, Ga., to Warren, Ohio. A few Hill sprinklers were made at the latter plant. The company sold out to the General Fire Extinguisher Co. in 1892.

HOFFMAN

Hoffman Sprinkler Co., Ltd., Manchester, England.

Upright, valve sprinkler with diaphragm. Very similar to Grinnell glass disc, except that jet is used instead of glass for the valve disc. Approved and used extensively in England. Agencies in Belgium, France, Germany, Norway and India.

HORACK

Chas. L. Horack, Brooklyn, N. Y.

Mr. Horack took out several patents between 1882 and 1885 for sprinklers of various types.

None ever used so far as known.

HOXIE

Edmund Hoxie, Everett, Mass.

1891. Pendent, valve sprinkler, the valve being of glass and held in place by two large levers soldered together at two points.

Deflector was a flat plate supported about half an inch in front of orifice by five metal bars. Never used so far as known.

IDEAL

Made by *Ideal Automatic Fire Extinguisher Co., Philadelphia, Pa.*

1912. Upright, valve sprinkler with diaphragm. Metal disc closed outlet in diaphragm and was held in place by strut. Experimental sample submitted to Underwriters' Laboratories for approval. Features criticized.

1. Halt or hesitation in normal operation.
2. Deterioration resulting from corrosion or loading.
3. Possibility of premature operation under sustained service pressures.
4. Inability to withstand ordinary abuse.
5. Lack of uniformity in manufacturing.
6. Materials employed.
7. Construction details.

IDEAL A.

Never used so far as known.

Feb. 1913. Experimental sample similar to No. 1, but with different deflector and strut. Features criticized all but 1 and 4 of the above. Also normal operation of hard and extra hard degree rating sprinklers.

A–1914. Similar to previous type but with key on releasing device extending around edges of strut.

Approval recommended by report of Underwriters' Laboratories.

INDEPENDENT

See *Stantial.*

Independent Fire Sprinkler Co., Chicago.

INTERNATIONAL

Manufactured and installed by the *International Sprinkler Co. of Philadelphia.* Also installed by several licensees in this country and by the *Sprinkler Company, Ltd.*, abroad. Head office of latter company in London. Branch offices in *Amsterdam, Brussels, Milan, Calcutta, Shanghai, Mexico, South Africa, North China, Yokohama* and other places.

The International Sprinkler Co. was founded in 1899 succeeding the Universal Sprinkler Co. and installed at first the Universal Sprinkler. See page 52.

1–1900. Patented by J. C. Scott.

Upright, valve sprinkler similar to the Universal No. 2.

Link $\frac{1}{2}$ inch wide. Cast metal valve disc.

Field experience fairly satisfactory.

INTERNATIONAL–1

INTERNATIONAL–B

Criticized by the Underwriters' Laboratories in 1902: (1) Releasing device, (2) cap, (3) solder, (4) construction details.

Not approved.

Rating: *Uncertain.*

A–1902. Patented by Powell Evans.

Similar to No. 1 except link was made of bronze instead of brass and projections were placed on frame where link would touch it.

Approved 1902 by Underwriters' Laboratories.

Some trouble experienced from those made in 1902–1904, by premature opening due to cold flow of solder in link. A large number were replaced.

Present rating: *Satisfactory except danger of prematureopening.*

A–2 1905. Same as *A* but link made wider ($\frac{1}{32}$ inch). See page 53.

Rating: *Standard.*

B–1906. Same as *A*–2 except slight changes in marking.

Rating: *Standard.*

Note: Special deflectors are also made for aisle lines in car barns, one to distribute in two directions to go between cars, and one to distribute in one direction to go along walls. This company was bought out by the "Automatic" Sprinkler Co. of America in 1911.

JAHN

F. G. Jahn, New York. Made by *Standard Equipment Co., New York.*

1891. Pendent, solid head sprinkler. There was no valve in this sprinkler but a groove was cut in the solid casting at the point where a valve would ordinarily be introduced. There was a heavy lever hinged at one end and attached to the piping by means of a fusible link. When the weight dropped, the lever forcibly broke open the head at the groove. Fixed toothed deflector. Never used so far as known.

1891. Upright, valve sprinkler. Porcelain valve cap held in place by four-piece strut, two members of which extended horizontally. Toothed deflector. Not used to any extent so far as known.

Obsolete.

Present rating: *Unreliable.*

JORDAN

Wm. S. Jordan, Worcester. Assigned to *Braman, Dow & Co., of Boston.*

1885. Pendent, valve sprinkler, drop deflector type. A large hollow casting contained interior guide for valve which was held against seat by a series of hinged levers bearing against adjustable spindle. Levers tripped by the melting of a short bar of solder under tension.

Never used so far as known.

KANE

Patented by *John and William Kane of Philadelphia.*
Installed by *Wm. Kane Fire Extinguisher Co.; Universal Automatic Sprinkler Co.* and *John Kane Fire Extinguisher Co.*

W. KANE

1–1881. Pendent, valve sprinkler. Valve held in place by a yoke hooked to a projection at one side of the head and soldered to a projection on the other side. Loose cap covered the lower end when the head was closed.

Obsolete.

Present rating: *Unreliable.*

1½–1881. Similar to No. 1 except that there was an arm extending from one side of the head. The yoke was hooked at one end as in No. 1, but at the other end it hooked over a lever which passed through the arm and was soldered to a projection at end of the arm.

Obsolete.

Present rating: *Unreliable.*

2–1882 Eclipse. Pendent, valve sprinkler of globe valve type. Horizontal valve held in place by a compli-

cated system of levers. Loose cap over lower end. See page 33.

Obsolete.

Present rating: *Unreliable.*


W. KANE–1


W. KANE–2

3–1888 Bulb Root. Pendent, valve sprinkler. Interior valve held in place by two levers. One lever held to projection on casting by two-piece link.

Nearly obsolete.

Present rating: *Unreliable.*


W. KANE–3


W. KANE–4

4–1892 Perfection. Pendent, valve sprinkler of drop deflector type. Valve held by levers and link similar to those in No. 3.

Out of 28 recently tested by the Underwriters' Laboratories, 7% failed.

Nearly obsolete.

Present rating: *Doubtful.*

Note: In 1893 the William Kane Fire Extinguisher Co. sold out to the General Fire Extinguisher Co. and the No. 4 Perfection head was made at the Warren, Ohio, shop of that company for some months.

J. KANE

Made by *Universal Automatic Sprinkler Co.*

1–1892 Universal. Pendent, valve sprinkler. Similar to Wm. Kane No. 4, but with fixed toothed deflector.

Out of 6 recently tested by the Underwriters' Laboratories, 33% failed.

Nearly obsolete.

Present rating: *Doubtful.*

J. KANE–1

J. KANE–2

2–1892 Universal. Frame similar to No. 1. Drop deflector similar to Wm. Kane No. 4.

Out of 127 recently tested by the Underwriters' Laboratories, 14% failed from adhesion at seat, etc.

Present rating: *Doubtful.*

2½–1892. Similar to No. 2 with fixed toothed deflector.

Present rating: *Doubtful.*

3–1900. Made by *Niagara Sprinkler Co.* and later by *John Kane Automatic Fire Extinguisher Co.*

Upright, valve sprinkler. Valve cap held in place by toggle-joint levers and link. Liable to leakage. Field experience otherwise fairly satisfactory.

Present rating: *Uncertain.*

4–1902. Upright, valve sprinkler. Similar to No. 3 but with levers farther apart. Liable to leakage. Field experience otherwise fairly satisfactory.

Out of 42 recently tested by the Underwriters' Laboratories, 10% failed.

Present rating: *Uncertain.*

4½–1902. Similar to No. 4 but with longer levers.

Present rating: *Uncertain.*

Note: The J. Kane Automatic Fire Extinguisher Co. sold out to the International Sprinkler Co. in June, 1902, and the latter company manufactured a few J. Kane No. 4 heads until Nov., 1902.

KERSTETER

Chas. W. Kersteter, Chicago, Ill.

A–1888. Single arm type. Valve sprinkler with valve held by a horizontal lever hooked at one end, the other end being hooked to a vertical lever soldered at the upper end to the frame. Deflector supported by a single arm. But few installed.

Practically obsolete.

Present rating: *Unreliable.*

1–1889. Upright, valve sprinkler. Valve held in place by two levers hooked at lower end to frame and held together at upper end by a fusible link spanning the head. Perforated toothed deflector. See page 55.

Practically obsolete.

Present rating: *Unreliable.*


KERSTETER--1


KERSTETER--2


KERSTETER--3

2–1893. Upright, valve sprinkler. Valve held in place by strut. Crude in workmanship and lacking in sensitiveness.

Present rating: *Unreliable.*

3–1898. Manufactured by *Niagara Fire Extinguisher Co., Akron, Ohio.* Upright, valve sprinkler similar to No. 2, but somewhat larger. Subject to crawling and leaking. About 30,000 made. Many replaced by manufacturers. Nearly obsolete. Not made after 1899.

Present rating: *Unreliable.*

4–1897. Upright, valve sprinkler, patented by E. M. Cook of Indianapolis. Assigned to Charles W. Kersteter. Valve held by three-piece strut.

Never used so far as known.

5–1898. Similar to No. 3 but with four-piece strut.

LACONIA

See *Vogel.*

LANG AND MILLER

1912. Application made to Underwriters' Laboratories in March, 1912, by Lang and Miller of New York.

No sample submitted to date.

LANGFORD

Wm. S. Langford, Baltimore, Md.

1898. Upright, valve sprinkler. Valve cap held by strut. Never used so far as known.

LAPHAM

Valentine Lapham, Chicago. Made by *Lapham Automatic Fire Extinguisher Co., St. Louis, Mo.* Later types by *Johnson-Rowe-Paige Co., Omaha, Neb.; McCrum-Howell Co., Chicago; and Ohio Automatic Sprinkler Co., Youngstown, Ohio.*

1–1890. Upright, valve sprinkler with valve cap held in place by three-piece strut of angular shape. Fixed perforated deflector.

Rating: *Unreliable.*

2–1894. Upright, valve sprinkler.

Rating: *Unreliable.*

3–1897. Modification of No. 2. Valve cap extended over edge of valve seat with spring underneath.

Rating: *Unreliable.*

4–1902. Upright, valve sprinkler. Toggle-joint levers. Experimental sample submitted to Underwriters' Laboratories. Criticized as follows:

1. Releasing device.
2. Effects of corrosion and loading.
3. Solder in high degree pattern.
4. Marking.
5. Distribution.
6. Structural weakness.

Never on the market so far as known.

Rating: *Unreliable.*

A–1910. Upright, valve sprinkler similar to No. 4 but with toothed deflector, flatter frame and heavier link. Made by Johnson-Rowe-Paige Co. Submitted to the Underwriters' Laboratories and criticized as follows:

1. Defects in soldering.
2. High and variable leakage point.
3. Inaccuracy in construction.
4. Distribution.
5. Marking.
6. Coloring.

A few of these heads were used in the middle West.

Rating: *Questionable.*

B–1911. Slight modification of *A*, but much the same in appearance. Approved by the Underwriters' Laboratories.

Rating: *Standard.*

LYNDE

Jas. H. Lynde, Manchester, England.

1–1887. Pendent, valve sprinkler with interior toothed deflector which dropped when head opened.

Never used in this country so far as known.

2–1893. Pendent, valve sprinkler similar to No. 1. Valve held in place by levers attached to a projection in frame by a two-piece rivet-shaped link. Never used in this country so far as known.

MACDANIEL

Valve sprinkler. Large deflector attached to valve disc. Held by strut with spring to throw it off centre. Never used so far as known.

MACKEY

John C. Mackey, Syracuse, N. Y. Installed by *Manufacturers Automatic Sprinkler Co.*

1–1883. Pendent, valve sprinkler. Conical shaped valve disc held in place by short strut bearing against brass wire levers. Levers held by two-piece curved link. Fixed deflector. Threaded for $\frac{3}{4}$-inch fitting. See page 36.

Now obsolete.

Present rating: *Unreliable.*


MACKEY–1


MACKEY–2


MACKEY–3


MACKEY–4

2–1885. Pendent, valve sprinkler. Interior valve at top of hollow casting. Stem $\frac{5}{16}$-inch diameter passed through $\frac{9}{16}$-inch hole in casting and was held by lever bar hooked at one end and soldered at other end. Fixed deflector. Threaded for $\frac{3}{4}$-inch fitting. Water way obstructed. See page 56.

Now obsolete.

Present rating: *Unreliable.*

3–1887. Similar to No. 1 but shorter and with valve stem held by two-piece lever, hooked at one end and held at other end by U-shaped piece of brass soldered around a projection which extended through a slot in lever.

Now obsolete.

Present rating: *Unreliable.*

4–1888. Patented by M. C. Pierce in 1891. Assigned to Manufacturers Automatic Sprinkler Co.

Interior valve sprinkler somewhat similar to No. 3 but longer and with toothed deflector. Valve of copper composition or white metal. Deflector ⅜ inch from frame. See page 56.

Practically obsolete.

Present rating: *Unreliable.*

Note: There was also an upright sprinkler made by Baker, Smith & Co., New York, about 1883, while Mr. Mackey was with them, that greatly resembled the Mackey head.

MANUFACTURERS–1

MANUFACTURERS–2

MANUFACTURERS–3

MANUFACTURERS

Made by *Manufacturers Automatic Sprinkler Co., Syracuse, N. Y.* These succeeded the Mackey heads. Some patents were in the name of C. W. Silver. This company was succeeded by the *"Automatic" Sprinkler Co. of America* in 1911.

1–1892. Pendent, valve sprinkler. Very similar to Mackey No. 4, except that deflector was further from frame (⅝ inch). Valve of metal, agate or glass. Head

was marked " Non Corrosive." Made for ¾-inch fitting. See page 56.

Nearly obsolete.

Present rating: *Unreliable.*

2–1895. Pendent, valve sprinkler. Very similar to No. 1 but with an elongated boss at end of threaded portion. Threaded portion ¾ inch in diameter.

Nearly obsolete.

Present rating: *Unreliable.*

3–1896. Pendent, valve sprinkler. Similar to No. 2 but longer and with a smaller deflector. Elongated boss as in No. 2.

Practically obsolete.

Present rating: *Unreliable.*

4 OR LONG LEVER.

4–1893. Long lever type. Upright, valve sprinkler of toggle-joint type. Valve of porcelain held in place by two long levers. A double T-shaped link fitted into slots at end of levers. See page 37. Later issues had spiral spring under porcelain valve. See page 57.

Field experience not satisfactory. Extremely subject to failure by corrosion and sticking of link. But few now in use.

The Underwriters' Laboratories have tested 25 heads of this type which averaged 14 years in service and 40% failed.

Rating: *Unreliable.*

A–1895. Upright, valve sprinkler. Similar to No. 4 but with shorter levers. Spring under valve. The link as in No. 4 was composed of a T-shaped piece with another piece of similar shape wrapped horizontally around the inner portion. This form of link has been found defective under continued strain and especially if subject to corrosion.

Criticized by Underwriters' Laboratories in 1902 as follows:

1. Releasing device.
2. Solder in high degree patterns.
3. Construction details.

Tests by the Underwriters' Laboratories on 175 samples which had been in use for an average of 12 years showed 20% failures.

Present rating: *Unreliable.*


MANUFACTURERS–B


MANUFACTURERS–C

B–1903. Upright, valve sprinkler. Similar to *A* but with small boss projecting above centre of deflector. Link of similar shape but with the outer part wrapped over the top of the inner portion. Valve cap rather close to frame so that corrosion at that point might cause trouble. This head has had a fairly satisfactory field experience, but should be carefully watched where subject to any corrosion or loading. Occasional tests desirable.

Out of 54 recently tested by the Underwriters' Laboratories, 9% failed.

Present rating: *Fairly reliable.*

C-1907. Upright, valve sprinkler. Similar to *B* but with bosses at end of lower lever so that link cannot be slipped off. Approved by Underwriters' Laboratories, 1907.

Rating: *Standard.*

Underwriters' Laboratories Caution, 1909.

"Last re-examination Feb. 1909 indicates defects in construction not present in samples formerly tested and which render the latest output of these devices unduly susceptible to the influences of corrosion."

These defects in construction were afterwards remedied and the head was approved unconditionally.

MARTIN

H. W. Martin, Ilion, N. Y.

1905. Upright, valve sprinkler. Valve of glass held by strut. Toothed deflector somewhat resembling the Grinnell sprinkler. Several variations.

Never used so far as known.

MASCOT

Wm. Shaffer.

1887. Interior valve sprinkler of elbow type. Valve held in place by pivoted levers. Operated by expansion of wax in closed receptacle. Levers were pushed off centre by small piston actuated by expanding wax. Used but little if any. See page 43.

Obsolete.

Rating: *Very unreliable.*

MAYALL

W. Mayall & T. Thomasson, Mossley, England.

1891. Valve sprinkler. Valve and deflector in one piece. Valve held by L-shaped lever soldered at lower end to frame. Never used in this country so far as known.

Installed in one mill in England but never officially approved there.

McLAUTHLIN

Geo. F. McLauthlin, Boston, Mass.

1894. Valve sprinkler. Upright and pendent types. Valve held in place by strut composed of levers. A heavy iron case surrounded the sprinkler, which in the upright type was in two pieces. This case was held in place by low-fusing solder. A small chain was attached to the case and to the valve strut. When heated the iron case was released and in falling pulled the strut levers off centre and opened the valve. Never used so far as known.

MILLER

J. A. Miller, Providence, R. I.

1878. Valve sprinkler with rose or perforated distributor. Valve opened against water pressure and was

operated by the expanding of brass rods placed under the sprinkler pipes. Never used so far as known.

MORRIS

Morris Sprinkler Co., Ltd., London, England.

Upright, valve sprinkler of toggle-joint lever type similar to last type of John Kane. Submitted to Underwriters' Laboratories in 1907. Criticized as follows:

1. Cold flow of solder joint.
2. Premature opening.
3. Distribution.
4. Marking.
5. Design of parts.
6. Strength.
7. Workmanship.

Never used in this country so far as known.

Formerly approved in England but approval withdrawn.

Levers poorly designed and head often failed.

MORRISON 2.

MORRISON

Morrison Brass Co., Toronto, Canada.

1. Upright, valve sprinkler very similar to the Grinnell glass disc head.
2. Upright, valve sprinkler similar to above but valve

held in place by duck bill levers similar to those used in the Esty sprinkler.

Neither type used to any extent so far as known.

NAGLE

Augustus F. Nagle, Chicago, Ill. Assigned to *Nagle Automatic Sprinkler Co.*

1–1890. Pendent, valve sprinkler. Interior valve opening against the water pressure. Valve stem threaded into a nut which was held in a closed case by

NAGLE–1

NAGLE–2

a heavy coiled spring. Spring was released by the fusing of two trip pieces soldered to projections on the outside of the case. When released the spring uncoiled and screwed the valve away from its seat. Deflector was a flat plate with raised perforated edge. See page 44.

Present rating: *Unreliable.*

2–1891. Pendent, valve sprinkler. Valve held by single lever hooked at one end and secured at other end by a three-piece link.

Obsolete.

Present rating: *Unreliable.*

NAYLOR

James Naylor, Jr., Boston.

1894. Upright, valve sprinkler. Valve held in place by glass strut filled with fluid that was supposed to ex-

pand when heated and break the glass. Never used so far as known.

Another type had a strut composed of two pieces of metal soldered together. Never used so far as known.

1895. Upright, valve sprinkler. Valve cap held by two levers set at an angle to the vertical. Held to frame by a fusible member consisting of two thin metal discs soldered together. Light and easily broken. Never used so far as known.

NERACHER

Wm. Neracher, Cleveland, Ohio. Installed by *Neracher Sprinkler Co., Neracher & Hill Sprinkler Co.*, and later by *General Fire Extinguisher Co.*

A–1882. Pendent, valve sprinkler. Valve held in place by lever hinged at one end and held at other end by a short trip lever. Long end of latter lever held by a plate bearing against a small vessel containing paraffine or similar material, fusing at about 120° F. Distribution from four curved rotating arms. Never used so far as known.

1–1884. Pendent, valve sprinkler, drop deflector type. Valve held in place by cross-shaped strut with horizontal arms soldered to frame. Lower part of strut placed at a slight angle with the vertical. Star-shaped deflector.

Obsolete.

Present rating: *Unreliable.*

1½–1886. Pendent, valve sprinkler similar to No. 1 except releasing device. Strut consisted of triangular-shaped spring with two lower ends soldered to frame.

Obsolete.

Present rating: *Unreliable.*

2–1887. Pendent, valve sprinkler. Similar to No. 1 except releasing device. Strut consisted of one short piece and one long angular piece, the long end of which was held to a projecting arm by a two-piece triangular-shaped link. See page 58.

Obsolete.

Present rating: *Unreliable.*


NERACHER–1


NERACHER–2

2½–1887. Pendent, valve sprinkler, similar to No. 2 except that releasing device consisted of levers extending over lower end of frame and held together by a fusible link.

Present rating: *Unreliable.*

3–1888. Upright, valve sprinkler. Valve held in place by four-piece lever. Outer levers of brass wire extended to top of sprinkler and were held together by a link similar to that used in No. 2.

Practically obsolete.

Present rating: *Doubtful.*

3½–1893. Upright, valve sprinkler. Similar to No. 3 except that the frame was slightly different in shape and levers were of stamped bronze. Unduly subject to the influence of corrosion.

Out of 92 recently tested by the Underwriters' Laboratories none failed.

Rating: *Doubtful.*

4–1895. Upright, valve sprinkler. Similar to No. 3 but a much shorter head. Outer levers of stamped bronze. Toothed, perforated deflector. Reliability somewhat doubtful, due to age.

Out of 30 recently tested by the Underwriters' Laboratories, 13% failed from tight fit between links and parts.

Present rating: *Doubtful.*


NERACHER–2


NERACHER–3


NERACHER–3

5–1902. Upright, valve sprinkler. Similar to No. 4 but somewhat shorter. Frame not adjustable.

Present rating: *Not standard; generally satisfactory.*

6–1902. Same as No. 5 but with toothed deflector. Hollow valve cap. Approved.

Rating: *Standard.*


NERACHER–4


NERACHER–5


NERACHER–6

NEW YORK

New York Automatic Sprinkler Co.

Patented by *B. P. Hall of Fanwood, N. J.* Assigned to *New York Automatic Sprinkler Co.*

1911. Upright, valve sprinkler with two-piece curved strut.

NEW YORK.

Reported upon by the Underwriters' Laboratories, July, 1912. Features criticized:

1. Deterioration from loading and corrosion.
2. Probability of premature opening.
3. Distribution.
4. Lack of uniformity of manufacture.
5. Design.
6. Construction details.

Rating: *Unreliable.*

NEW YORK AND NEW HAVEN

Made by *Foskett & Bishop, New Haven, Conn.; New York & New Haven Automatic Sprinkler Co., New York; John Simmons, New York.*

1–1889 (December). Mill type. Patented by *V. A. Harder of Brooklyn, N. Y.* Interior valve sprinkler of elbow type. Valve spindle held by two hooked levers with ends covered by a two-piece fusible link similar to

the Walworth link. Large deflector with raised slotted edge. Threaded for $\frac{3}{4}$-inch fitting.

Practically obsolete.

Present rating: *Unreliable.*

2–1889 (July). Riveted lever type. Patented by *Daniel C. Stillson of Somerville, Mass.* Interior valve sprinkler of elbow type. Similar to No. 1 except that levers were pivoted and deflector was smaller with raised perforated edge.

Practically obsolete.

Present rating: *Unreliable.*

NEWTON

Robert W. Newton, Providence, R. I. Installed by the inventor.

Patents taken out in 1891–1892 and 1893 for sprinkler heads that were never put on the market, so far as is known.


NEWTON.

1894. Upright, valve sprinkler. Metal valve disc held in place by strut consisting of five pieces at an angle, and three horizontal.

The horizontal pieces were soldered to a flat surface. Deflector had a raised perforated edge. This head used was to a considerable extent in Rhode Island and Eastern Massachusetts. After about ten years use this sprinkler gave trouble from sticking, especially when corroded. Now considered defective. Practically all have been replaced. Used to some extent in England.

Practically obsolete.

Present rating: *Very unreliable.*

Note: The sprinkler was slightly modified in patents taken out in 1902–1903 and 1905, the latter being assigned to the General Fire Extinguisher Co.

NEWTON

Newton Fire Extinguisher Co., Ltd., London, England.

Upright, valve sprinkler with diaphragm outlet.

Valve disc held by levers and link similar to those used in the International sprinkler.

Not used in America so far as known.

Used extensively in England and other parts of the world.


NEWTON


NIAGARA-HIBBARD--A

NIAGARA-HIBBARD

Manufactured by *Niagara Fire Extinguisher Co., Akron, Ohio.*

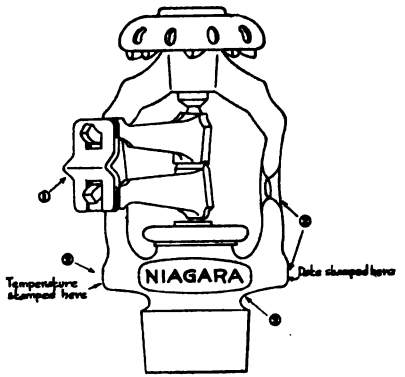
A–1902. Upright, valve sprinkler. Frame similar to Hibbard sprinkler, levers and link similar to Niagara sprinkler. V joint in link. Projections on frame where levers would touch. Stamped Niagara on one side and Hibbard on other side.

Underwriters' Laboratories report, 1902. Features criticized:

1. Effects of corrosion and loading.
2. Solder in high degree patterns.
3. Structural weakness.
4. Cap and construction details.

Rating: *Unreliable.*

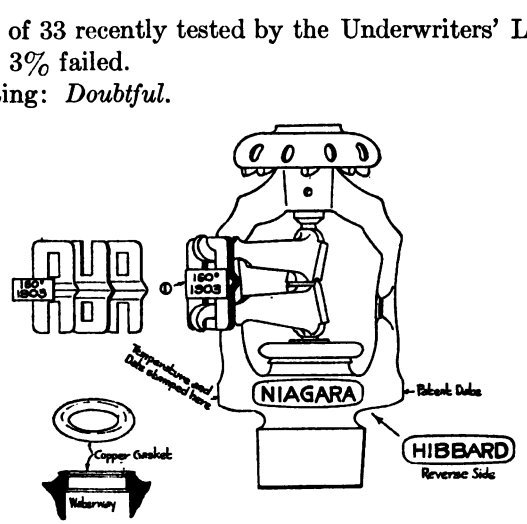
A_2–1903. Similar to 1902 type but with point on link reversed (pointing inward). Date and temperature marked on link.



NIAGARA-HIBBARD A–1902.

Out of 33 recently tested by the Underwriters' Laboratories, 3% failed.

Rating: *Doubtful.*

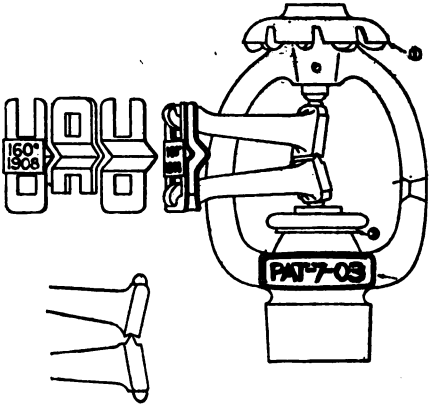


NIAGARA-HIBBARD A_2–1903.

B–1904. Similar to *A* but with more rounded frame, toothed deflector, and longer levers. Block tin gasket

in earlier issues; copper ring gasket in later issues. Nia-Hib cast on one side of wrench head and patent date on the other side.

Installed by Niagara Fire Extinguisher Co., Akron, Ohio. Approved by the Underwriters' Laboratories in



NIAGARA-HIBBARD B–1904.

1904. Withdrawn from approval in 1912, inasmuch as name of the device was changed to Niagara when Mr. Geo. E. Hibbard withdrew from the Niagara Fire Extinguisher Co. (See Niagara.)

Rating: *Satisfactory.*

NIAGARA

Manufactured by *Niagara Fire Extinguisher Co., Akron, Ohio,* and after 1912 by the *"Automatic" Sprinkler Co. of America at Youngstown, Ohio.*

B–1912. Practically the same head as Niagara-Hibbard *B.* Approved by the Underwriters' Laboratories.

Rating: *Standard.*

PARMELEE

Henry S. Parmelee, New Haven, Conn. Made by *J. R. Brown & W. A. Foskett, New Haven, Conn.*

Installed by *Foskett & Bishop, New Haven,* by the *Providence Steam & Gas Pipe Co.* and others.

First patent, 1874, showed a valve sprinkler held to its seat by fusible solder. Perforated distributor. Sprinkler fed by small pipe until an auxiliary valve was opened by the reduction in pressure.

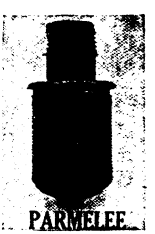
Never used so far as known. See page 17.

1–1874 (about). Upright, valve sprinkler. Interior valve held in place by hinged lever the end of which was fastened to an arm by means of a heavy spring and fusible link. Perforated distributor.

Used in Mr. Parmelee's piano factory (probably the first automatic sprinkler equipment ever installed). See page 17.

2–1874 (about). Upright, valve sprinkler. Interior valve held in place by a wooden strut the upper end of which had a bearing against a fusible washer. Perforated distributor. This head was also used to a limited extent in Mr. Parmelee's piano factory. See page 18.

3–1875. Upright, sealed sprinkler. Brass cap soldered over a perforated distributor. Threaded on inside. See page 18.



4–1878. Upright, sealed sprinkler. Brass cap soldered over a rotating turbine distributor. Threaded on inside. See page 19.

5–1878. Upright, sealed sprinkler. Similar to No. 4 but redesigned by Mr. Grinnell. The head was made more sensitive by recessing under the solder joint so that the heated air could circulate on each side of this joint. Threaded on the outside for a half inch fitting. Slow in action and easily damaged.

Field experience very satisfactory for some years. See page 19.

All types now obsolete.

Present rating: *All types unreliable.*

PHELPS

Fred A. Phelps, Laconia, N.H.

1–1904. Upright, valve sprinkler. Metal valve cap held in place by a seven-piece strut in the form of a double rectangle. Soldered surfaces corrugated.

2–1907. Sample similar to above tested by Underwriters' Laboratories, 1907, criticized as follows:

1. Deflector.
2. Markings.
3. Soldering.
4. Strength.

PHELPS 2.

3–1910. Experimental sample submitted to Underwriters' Laboratories, criticized as follows:

1. Features of design and construction.
2. Hard and extra hard degree solders.
3. Effects of loading and corrosion.

None of the types ever used so far as known.

PHŒNIX

Patented by *Jarvis Hunt, Chicago.*
Assigned to *Phœnix Fire Extinguisher Co.*

1–1904. Upright, valve sprinkler with diaphragm. Metal valve cap covered a raised orifice in diaphragm and was held by three-piece strut with a projection at an angle of about 45 degrees.

Never used so far as known.

A–1905. Upright, valve sprinkler similar to No. 1 except in shape of strut. Similar in appearance to Grinnell glass disc sprinkler except strut and diaphragm. Approved by the Underwriters' Laboratories, 1905.

Withdrawn from approval, 1909. Manufacture discontinued.

Field experience limited but generally satisfactory except in the matter of leakage and premature opening.

Out of 65 recently tested by the Underwriters' Laboratories, 3% failed from adhesion at the seat.

Present rating: *Fairly satisfactory.*

Note: The Phœnix Fire Extinguisher Co. was backed by the late Paul Morton, his brother and others. The company went out of business in 1909.

PHOENIX–A

PIERCE

PIERCE

Octavius Pierce, Chicago, Ill.
Assigned to *Underwriters Fire Sprinkler Co.*

1894. Upright, valve sprinkler. Valve held in place by four-piece strut of triangular shape. Fixed toothed deflector. Used to some extent in the central West. Subject to crawling and leaking. See page 60.

Present rating: *Unreliable.*

PRENTISS

See *Draper.*

ROCKWOOD

Geo. I. Rockwood, Worcester, Mass.

Manufactured and installed by *Worcester Fire Extinguisher Co.* Later by *Rockwood Sprinkler Co.*

1905. Patents taken out on upright, valve sprinkler with single deck deflector.

A–1906. Upright, valve sprinkler. Metal valve cap with pure silver washer held in place by four-piece strut of triangular shape. Double deck deflector, part being over and part under the frame.

Approved in 1907 by the Underwriters' Laboratories.

Field experience not satisfactory in the matter of leakage and premature opening. Have been practically all removed. See page 60.

Present rating: *Unsatisfactory.*

Later this head was slightly changed by installing a lump of solder at one end of the soldered lever to give additional strength.

ROCKWOOD–A

ROCKWOOD–B

B–1906. Slight modification of *A*. Key placed in top of soldered lever of strut to give additional strength.

Not approved by Stock Companies. Used in risks insured in Mutual Companies.

Present rating: *Satisfactory.*

C–1910. Similar to *A* except solder joint strengthened by installing a reinforcing wire.

Approved by the Underwriters' Laboratories. Many in use.

Present rating: *Satisfactory.*

D–1911. Similar to *C* but with single deck deflector. Approved by Underwriters' Laboratories and the Mutual Companies. Many in use. See page 60.

Present rating: *Standard.*


ROCKWOOD–C


ROCKWOOD–D

RUNDLE SPENCE

Made by *Rundle Spence Automatic Sprinkler Co., Milwaukee, Wis.*

1–1911. Upright, valve sprinkler. Almost identical with Neracher Improved 1902 sprinkler. No distinguishing marking except that rating and year of manufacture were stamped on link.

A few were installed in the middle West.

Rating: *Questionable.*

2–1912. Similar to 1911 type except that the letters R. S. were cast at an angle on the upper edge of the frame and notches were provided in levers to prevent link from coming in contact with top of frame.

Underwriters' Laboratories report, March, 1913, makes following criticisms:

1. Effects of loading and corrosion.
2. Adhesion of valve cap and disc to seat.
3. Inaccuracies in high test solder.
4. Factors of safety in link, frame and cap.
5. Lack of uniformity of manufacture.
6. Construction details.

Rating: *Questionable.*

A–1913. Similar to 1912 type but letters R. S. in a vertical position and further from link. Rating and date stamped on link.

Approved Sept., 1913, by the Underwriters' Laboratories.

Rating: *Standard.*

RUNDLE SPENCE.

RUTHENBURG

Marcus Ruthenburg, Cincinnati, Ohio.

1885. Pendent, valve sprinkler.

Rubber valve disc of spherical form held in place by long thin lever. Lever held to arm by cylindrical link of solid solder.

Fixed saucer-shaped deflector.

Used to a limited extent in the middle West. Crude and subject to crawling. See page 37.

Obsolete.

Present rating: *Very unreliable.*

SHAW

C. B. Shaw, Kirkwood, Mo. Made by *Shaw Manufacturing Co., St. Louis, Mo.*

1–1897. Upright, valve sprinkler with keyed strut. Key released by expansion of alcohol or ether in a closed vessel with corrugated sides. Slightly modified in 1899. Subject to corrosion. Unreliable principle of release. A few equipments were

installed in the neighborhood of St. Louis, Mo. See page 45.

Present rating: *Very unreliable.*

SIMMONS

J. Simmons Co., New York.

Upright, valve sprinkler. Practically a duplicate of the Stantial.

Never used so far as known.

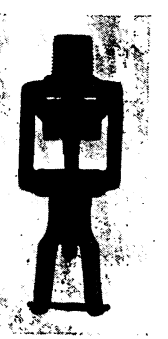
SIMPLEX

Made by *Crowder Bros., St. Louis, Mo.*

1902. Upright, valve sprinkler. Porcelain valve cap held by toggle-joint levers and link. Criticized by Underwriters' Laboratories as follows:

1. Releasing device.
2. Effects of loading and corrosion.
3. Leaking point.
4. Cap.
5. Disc.
6. Deflector.
7. Marking.
8. Structural weakness.
9. Construction details.

Never on market so far as known.



SMITH.

SMITH

Darius B. Smith, Pine Meadow, Conn.

1885. Pendent, valve sprinkler of drop deflector type. Valve stem threaded into two parallel vertical levers. Levers held together by two-piece link. Conical-shaped deflector. A few hundred made. Used only in Mr. Smith's own factory. Gave trouble from leakage due to turning of threaded stem from vibration.

Obsolete.

Present rating: *Very unreliable.*

STANDARD

Made by the *National Fire Extinguisher Co., Kansas City, Mo.*

1902. Upright, valve sprinkler. Valve cap held by levers of toggle-joint type and fusible link. Quite similar to Hibbard sprinkler. Criticized by the Underwriters' Laboratories in 1903 as follows:

1. Fusing point.
2. Releasing device.
3. Effects of corrosion and loading.
4. Structural weakness.
5. Solder in high degree pattern.
6. Marking.
7. Workmanship.

Out of 77 recently tested by the Underwriters' Laboratories, 8% failed from adhesion at the seat.

No longer made.

Rating: *Unreliable.*

STANTIAL

Otis T. Stantial, Chicago, Ill. Made by *Independent Fire Sprinkler Co., Chicago, Ill.*

1895. Upright, valve sprinkler. Valve cap held in place by strut with curved projecting member. Report of Underwriters' Laboratories, 1903, criticized:

1. Fusing point.
2. Releasing device.
3. Effects of corrosion and loading.
4. Cap.
5. Solder in high degree pattern.
6. Marking.
7. Distribution.

Out of 83 recently tested by the Underwriters' Laboratories, 5% failed.

Used to a limited extent.

Present rating: *Unreliable.*

STAR

Wm. T. Montgomery of Wakefield, Mass. Assigned to *Star Manufacturing Co. of Boston.*


STAR

1886. Pendent, valve sprinkler. Metal valve with stem held in place by lever, one end being hooked to casting and the other attached to a projection by a solder pin. Large star-shaped deflector. Installed to a considerable extent in New England by the Star Manufacturing Co. Sold out to Providence Steam & Gas Pipe Co. Field experience satisfactory for a number of years.

Obsolete.

Present rating: *Unreliable.*

STECK

Ernst F. Steck, Chicago, Ill. Assigned to *Fire Extinguisher Manufacturing Co.*

1896. Upright, valve sprinkler with valve cap held in place by triangular-shaped strut.

Never used so far as known.

STRATTON

W. H. Stratton, New Haven, Conn., and later of *Providence, R. I.*, and *Hartford, Conn.*

1–1885. Pendent, valve sprinkler of drop deflector type. Valve held in place by two levers hooked to frame and soldered together at lower side of head.

Never used so far as known.

2–1893. Pendent, valve sprinkler. Valve held in place by spindle passing through deflector and resting on a thimble soldered to frame. All working parts of sprinkler protected against corrosion by a papier maché protecting cover.

Never used so far as known.

3–1896. Upright, valve sprinkler. Valve seated on a hole in flexible diaphragm. Valve consisted of a frangible stopper adapted to contain a bursting charge. Stopper was clamped in place and when heated it was broken into small pieces.

Whole head enamelled to prevent corrosion.

Slightly modified in 1902.

Never used so far as known.

SWAN

Phineas W. Swan, Winchester, Mass.

1–1892. Pendent, valve sprinkler. Valve cap held in place by levers of toggle-joint type curved and pointing upwards. Levers held by two-piece fusible link. Fixed toothed deflector.

Never used so far as known.

2–1895. Upright, valve sprinkler similar to No. 1 but with slotted revolving deflector. But little used, if at all.

Present rating: *Unreliable.*

TALCOTT

Charles W. Talcott, Woonsocket, R. I.

Installed to some extent by inventor who afterwards installed other makes of sprinklers.

1–1882. Pendent, valve sprinkler. Interior valve held in place by hinged cap, the latter being held by fusible pin. Rose distributor.

Obsolete.

2–1882. Pendent, valve sprinkler. Valve of soft metal held in place by two hinged levers bearing directly on the valve cap. Levers were curved and extended around bottom of sprinkler where they were soldered together. Rose distributor.

Obsolete.

Present rating: *Very unreliable.*


TALCOTT

TESSIER

Made by *Joseph Tessier, New Bedford, Mass.*

Submitted to Underwriters' Laboratories, 1901. Undeveloped device.

Practically all features criticized.

Never used so far as known.


TITAN


TITAN-2

TITAN

George Mills & Co., Ltd., Manchester, England.

1. Pendent, valve sprinkler of drop deflector type; valve held by lever and rivet-shaped fusible link.

2. Upright, valve sprinkler. Valve disc held in place by strut the parts of which are held together by a rivet-shaped fusible piece similar to that used in No. 1. Apparently easily clogged by dirt and corrosion.

Installed in England and many other parts of the world. Not used in America so far as known.

TURNER AND GARDINER

1895. Valve sprinkler with perforated distributor. Valve spindle held in place by long lever hinged at one end and attached to piping or to ceiling by a spring and cotton cord.

Never used so far as known.

UNIVERSAL

Universal Automatic Sprinkler Co., Philadelphia, Pa. John Kane, General Manager. Later reorganized as the *International Sprinkler Co.* This company previously installed the J. Kane sprinklers No. 1 and No. 2.


UNIVERSAL--1


UNIVERSAL--2

1-1896. Upright, valve sprinkler. Valve held in place by straight strut. Perforated and toothed deflector.

Not used so far as known.

2–1899. Upright, valve sprinkler. Similar to **No. 1** except valve cap held by levers of the toggle-joint type with link.

Present rating: *Unreliable.*

Note: There was also a sprinkler similar to No. 1, but with an irregular-shaped three-piece strut, invented by Robert Wood. Never used so far as known.

UP-TO-DATE

Made by *U. T. D.* (*Up-to-date*) *Sprinkler & Supply Co., Chicago, Ill.*

1899. Upright, valve sprinkler. Valve cap held in place by strut. Small smooth deflector.

Criticized by Underwriters' Laboratories, 1905, as follows:

1. Crude workmanship.
2. Subject to crawling and leakage.
3. Distribution faulty.

Out of 134 recently tested by the Underwriters' Laboratories, 7.4% failed from adhesion at seat and lack of motive power.

Present rating: *Unreliable.*

OR VOGEL.

VOGEL

Made by *H. G. Vogel Co., New York.*

1904. Upright, valve sprinkler. Valve cap held in place by double strut. Fixed toothed deflector. Two

horizontal projections on casting just above threaded portion. Experimental sample criticized by Underwriters' Laboratories in 1904 as follows:

1. Structural weakness.
2. Soldered struts.
3. Spring.
4. Distribution.
5. Markings.
6. Construction details.

Never used so far as known in America.

Approved in England under the name Laconia, but not used there to any extent.

WALWORTH

Patents by *C. C. Walworth* and *O. B. Hall of Boston.* Made and installed by *Walworth Manufacturing Co., Boston.* Patents were taken out in Feb., 1883, and July, 1883, by *C. C. Walworth* on experimental samples that were never used to any extent.

WALWORTH–1

WALWORTH–2

1–1883 (October). Soldered arm type. Patented by C. C. Walworth and O. B. Hall. Pendent, valve sprinkler. Valve held by stem resting against a rocker arm lever. Long arm of lever soldered to frame. Not a sensitive head.

Obsolete.

Present rating: *Very unreliable.*

2–1883. Solder link type. Similar to No. 1 except that whole deflector dropped when head opened. Long arm of lever held to a projection on frame by an all-solder link. This link caused leakage by stretching and later a two-piece metal link was used. See page 36.

Obsolete.

Present rating: *Unreliable.*

2 A–1883. Drop deflector type. Similar to No. 2 but with link composed of two U-shaped pieces of brass soldered together.

Rating: *Unreliable.*

WALWORTH–3

WALWORTH–4

WALWORTH–5

3–1885. Soldered deflector type. Pendent, valve sprinkler similar to No. 2 except that deflector was large and stationary. Valve disc passed through hole in centre of deflector. There were several slight modifications of this sprinkler and in later types a link was used in which the two parts were placed side by side instead of one being entirely within the other. See page 36.

Present rating: *Unreliable.*

4–1888. Ordinary type. Pendent, valve sprinkler. Similar to No. 3 but with a smaller and smoother deflector. Hexagonal casting for wrench just below threaded portion. See page 61.

Present rating: *Unreliable.*

5–1888. Upright, spring type. Similar to No. 4 but arranged to be placed upright. Steel spring tended to force valve open when link melted. Practically obsolete.

Present rating: *Unreliable.*

WALWORTH–6

WALWORTH–7

6–1892. Smooth deflector type. Upright, valve sprinkler. Valve cap attached to a hinged lever, the upper end of which was held to a projection on the casting by a fusible link. Small smooth deflector. Poor distribution. Nearly obsolete. See page 61.

Present rating: *Unreliable.*

WALWORTH–8

WALWORTH–9

7–1894. Ordinary upright type. Similar to No. 6 but with perforated deflector.

Present rating: *Unreliable.*

8–1898. Improved pendent type. Similar to No. 6 but with improved toothed deflector, more clearance of levers, etc.

Present rating: *Unreliable.*

9–1899. Improved upright type. Similar to No. 7 but with toothed deflector and more clearance of moving parts.

Present rating: *Unreliable.*

Note: There are several other minor variations of the above types. Most of the Walworth heads made after 1892 had double links as a safeguard against crawling of solder in the single link. These were generally wired together so that the outer one would not slip off. A few were wired at the side instead of at the end, thus binding the moving parts of the link together and causing failure to operate.

Melting points of many of the high test patterns were irregular. Walworth heads had a satisfactory field experience up to 1912, when tests showed them to be unreliable.

Out of about 1500 tested by the Underwriters' Bureau of New England between 1911 and 1914, 30 per cent failed.

They are now gradually being replaced.

WESTON

A. L. Weston, Adams, Mass.

1899. Upright, valve sprinkler. Valve cap held by rectangular strut composed of several pieces soldered together and with a concealed spring.

Report of Underwriters' Laboratories, 1902, criticized:

1. Fusing point.
2. Structural weakness.
3. Releasing device.
4. Cap.
5. Solder in high degree patterns.

Never used so far as known.

WESTON.

WHITING

Francis Whiting, Chelsea, Mass.

1881. Pendent, water-joint type. Perforated distributor, fan shape in cross section. Cap soldered to flanged edge. Used to some extent about 1884. Sold out to Burritt Hardware Co. of Waterbury, Conn.

Obsolete. Not a sensitive type. See page 28.

Present rating: *Unreliable.*

WILBER

Wilber & Son, Bolton, England.

1889. Pendent sprinkler. Valve disc held in place by levers soldered together. Water distributed from a circle of holes discharging onto a loose toothed ring.

Not used in this country so far as known.

WILSON

W. A. Wilson.

1882. A large thimble-shaped cap fitted over an orifice and was held in place by a strap of thin metal containing a fusible joint.

Never used so far as known.

WITTER

Witter & Son, Bolton, England.

1. Pendent, valve sprinkler. Valve held in place by lever hooked to frame at each end and with adjusting

screw passing through the centre. Fusible joint consisted of two flat angular parts pivoted at top and soldered together at lower end. Spring under valve disc.

E–1906. Upright or pendent, valve sprinkler. Valve disc held in place by strut. Spring under valve disc.

Not used in America so far as known.

Used extensively in England and other countries.

WOOD

Robert Wood, Philadelphia, Pa.

1896. Mr. Wood while with the Universal Sprinkler Co. of Philadelphia invented several sprinklers. The frame of the Universal sprinkler was used but the valve discs and releasing devices were of several patterns, most of which resembled those used in other sprinklers.

None of these were ever used so far as known.